

SCIENCE

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FOR THE ADVANCEMENT OF SCIENCE.

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FRIDAY, FEBRUARY 13, 1903.

THE AMERICAN ASSOCIATION FOR THE
ADVANCEMENT OF SCIENCE.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

SECTION F, ZOOLOGY.

SECTION F was organized at the Washington meeting on December 29, 1902, with the following officers:

Vice-President—C. W. Hargitt.

Secretary—C. Judson Herrick.

Fellow Elected to the Council—Charles L. Marlatt.

Sectional Committee—C. W. Hargitt, Vice-President, Washington meeting; C. Judson Herrick, Secretary, Washington meeting; C. C. Nutting, Vice-President, Pittsburgh meeting; C. W. Stiles, Secretary, Pittsburgh meeting; C. L. Edwards, to serve one year; H. F. Osborn, to serve two years; S. H. Gage, to serve three years; C. H. Eigenmann, to serve four years; H. B. Ward, to serve five years.

Member to General Committee—Herbert Osborn.

Meetings of the section for the reading of papers and other business were held on December 29, 30, 31 and January 1.

At a joint meeting of the section with the American Society of Zoologists, December 30, it was 'Resolved, That it is the sense of this meeting that the *Concilium Bibliographicum* of Zurich is of the greatest value to zoologists, and it is recommended to the Carnegie Institution for financial assistance.'

The following papers were presented before the section :

*Tadpoles of the Green Tree Toad (*Hyla versicolor*) and Comparison with the Common Toad (*Bufo lentiginosus*):*
SIMON H. GAGE, Cornell University.

The most obvious, although by no means the most important, change in transformation is the disappearance of the tail. Comparing the common and the tree toad, it was found that in the tadpoles of the common toad the tail shortened 4.6 mm. in 24 hours, while that of the tree toad shortened 24 mm. in 24 hours, or more than five times as rapidly as the common toad. Although the common toad is considerably larger than the tree toad, the tadpoles of the latter are much the larger—that is, from two to three times the length from tip to tip. If one compares the percentage of the total length which disappears in the two cases, it is found that in *Bufo* the diminution is 25.5 per cent., while in *Hyla* it is 47 per cent. in 24 hours. That is, the relative as well as the absolute amount of shortening is greater in the tree toad in a given time.

In coloration the common toad tadpoles are entirely black or barred. The small tadpoles of *Hyla* are less deeply pigmented, but of nearly a uniform shade. As the tadpoles approach their greatest perfection as tadpoles, the coloration assumes a brilliant red, mottled with black. This makes them very conspicuous. The appearance is especially striking when the sunshine is strong. When transformation approaches, the green color so characteristic of younger tree toads appears on the body, and the red may become less brilliant in the tail, but often that remains and the animal is brilliant in red and green.

Every effort to get at the meaning of this coloration in the tadpoles was unsuccessful. It can not be for attraction, as the animals are immature. It can not be for protection, as there are no similarly colored objects in the water. It can not

be a warning color, as the animals are readily eaten by animals living more or less on tadpoles.

The Habits of Cryptobranchus: ALBERT M. REESE, Syracuse University, Syracuse, N. Y.

Cryptobranchus alleghaniensis, or hellbender, occurs in great numbers in streams of the Ohio valley, but is apparently seldom found outside of that region. It sometimes reaches a length of 60 cm., and though it is a repulsive looking animal, and has the reputation among fishermen of being poisonous, it is really a most harmless and inoffensive creature.

Respiration in the adult is by means of well-developed lungs, but there is a persistent gill-opening on each side of the throat. Air for respiration is taken in by a curious swallowing motion, and is exhaled partly by a quick expiration, when the animal comes to the surface to breathe, and partly by bubbles set free as the animal lies on the bottom. In captivity, the respiration intervals seem to be quite variable, the average length of time between inspirations being about 15 minutes, the longest recorded interval being 43 minutes.

Under natural conditions, the hellbender seems to be a remarkably voracious animal, living chiefly on small fish, crayfish, etc., but in captivity its appetite is quite moderate, a few small pieces of raw liver once or twice a week being all that it will eat in the summer, while in the autumn several specimens kept under observation in a tank refused to eat during a period of over two months. One morning at the end of this long voluntary fast, a black object was seen projecting from the mouth of a large hellbender which, on closer examination, proved to be the tip of the tail of a smaller individual which had been swallowed head first. By means of forceps the small hellbender was rescued from his strange pre-

dicament, and immediately swam away, none the worse for his terrible experience. Even after this apparent evidence of returning appetite, the hellbenders ate but little of the liver that was given them. Their remarkable tenacity of life is shown by the fact that an individual that escaped from the tank lived for three weeks without food and water.

Nothing was learned as to the breeding habits except the fact that they will not breed in captivity, unless, perhaps, they are captured just before their natural spawning season.

Sense of Hearing in Fishes: G. H. PARKER,
Harvard University, Cambridge, Mass.
To be published in *Bull. U. S. Fish
Commission.*

The presence of an internal ear in fishes led Hunter, Müller, Owen and other physiologists to ascribe hearing to these animals. The fact that after the loss of the ear fishes lose their equilibrium, but still respond to sound waves if intense enough, led Kreidl and especially Lee to conclude that the internal ears of fishes were for equilibration and not hearing, and that sound waves stimulate the skins of fishes, not their ears. Fishes, therefore, feel sounds, but do not hear them. *Fundulus heteroclitus*, after having had the nerves to its integument and to its lateral line organs cut, thus rendering its skin insensitive, still responds by fin movements to sound waves, but ceases so to respond after the nerves to the internal ears are cut. *Fundulus heteroclitus*, therefore, responds to sound waves through the ear—that is, it hears.

*Breeding Habits of the Yellow Catfish
(Ameiurus nebulosus):* HUGH M. SMITH.
To be published in *Bull. U. S. Fish
Commission.*

This paper is based chiefly on observation of a pair of fish from the Potomac River in the Fish Commission aquarium

at Washington. They made a nest on July 3, 1902, by removing in their mouths upwards of a gallon of gravel from one end of the tank, leaving the slate bottom bare. On July 5 about 2,000 eggs, in four separate agglutinated clusters, were deposited between 10 and 11 A.M. on the scrupulously clean bottom. Ninety-nine per cent. hatched in five days in a mean water temperature of 77° F. The young remained on the bottom in dense masses until six days old, when they began to swim, at first rising vertically a few inches and immediately falling back. By the end of the seventh day they were swimming actively and most of them collected in a school just beneath the surface, where they remained for two days, afterwards scattering. They first ate finely-ground liver on the sixth day, and fed ravenously after the eighth day. The fish were 4 mm. long when hatched, and grew rapidly, some being 18 mm. long on the eleventh day, and at the age of two months their average length was 50 mm.

Both parents were very zealous in caring for the eggs, keeping them agitated constantly by a gentle fanning motion of the lower fins. The most striking act in the care of the eggs was the sucking of the egg-masses into the mouth and the blowing of them out with some force. The fanning and mouthing operations were continued with the fry until they swam freely, when the care of the young may be said to have ceased. During the first few days after hatching, the fry, banked in the corners of the tank, were at irregular intervals actively stirred by the barbels of the parents, usually the male. The predaceous feeding habits of the old fish gradually overcame the parental instinct; the tendency to suck the fry into their mouths continued and the inclination to spit them out diminished, so that the number of young dwindled daily and the 500

that had been left with their parents had completely disappeared in six weeks, although other food was liberally supplied.

The Effect of Low Temperatures on Mosquito Larvæ: JOHN B. SMITH, New Brunswick, N. J. To be published in Final Rep. of Mosquito Investigation, N. J.

Mosquitoes were, until recently, supposed to hibernate as adults, and it was believed that low temperatures checked or absolutely prevented the development of larvæ.

A series of observations made in New Jersey during the winter of 1901-02 and the last months of 1902 indicate that even freezing temperatures do not entirely prevent development, though they may delay it. The species vary in method of hibernation, some living through as adults, some as larvæ, and some in the egg stage. None winter as pupæ. The larvæ that hibernate may be frozen solidly in ice and will come to no harm. Temperatures down to zero (Fahrenheit) do not prevent final maturity, and the freezing and thawing may be repeated several times during the winter without bad effects.

Of species that hibernate as adults, many larvæ of the later broods are caught by frosts and may be ice-bound for a time without harm. The larvæ of *Culex punctans* have been observed in a pail coated with ice one fourth inch thick, barred absolutely from access to the outer air for several hours, and they completed their development in due time after the ice disappeared. Pupæ of the same species have been frozen in a solid mass of ice and transformed into adults later.

Concerning *Anopheles punctipennis* the same observation has been made, and both larvæ and pupæ were taken from pools that had been completely ice-coated for several hours.

Species which in the larval stage have survived freezing, or at least being bound in ice-covered pools, are *Anopheles punctipennis*, *Culex canadensis*, *Culex sylvestris*, *Culex pipiens*, *Culex restuans*, *Culex territans*, *Aedes smithii* and *Corethra brakeleyi*. Of *Aedes smithii* it is positively known that it winters in the larval stage only; of *Anopheles punctipennis* and *Culex pipiens* it is positively known that they winter as adults only. Of *C. canadensis* and *C. sylvestris* it is believed that they winter in the egg stage; but it is not certain that they do not also winter as larvæ. Of *C. territans* it has been said that it winters as an adult, but the larvæ are found very late in winter and very early in spring.

Notes on the Natural History of Some of the Nudibranchs: W. M. SMALLWOOD, Syracuse University, Syracuse, N. Y. To be published in *Bull. Syracuse University*.

During the past summer at Woods Holl the following nudibranchs were secured: *Montagia gouldii*, *Montagia pilata*, *Doris bifida*, *Eolis papillosa* and *Elysia chlorotica*. The classification is according to Verrill.

Montagia gouldii was found in large numbers in the colonies of *Tubularia coccinea*. *Montagia pilata* was taken by dredging. *Doris* and *Eolis* were found at low tides on rocks and weeds. *Elysia* was taken in a tow-net, but did not lay while under observation; the other forms laid very freely in common glass aquaria.

One hundred and fifty specimens of *Montagia gouldii* laid 929 masses of spawn within nine days after being brought into the laboratory, and hundreds of egg masses might have been collected from the hydroids from which these were taken. The spawn was scattered or laid in nests;

it is small and fan-shaped, containing about 500 eggs.

The ends of the oviducts in the copulation of *M. pilata* become firmly united, so that the animals may be pulled apart with considerable freedom. While in copulation the swollen ends of the oviducts are spherical in form and the color is intensified. It may take three hours for the distended oviduct to become completely retracted. The egg mass is laid in the form of a straight or undulating string frequently six inches long. There are from two to eight eggs in a single section of the string. Deposition occurs from twelve to twenty-four hours after copulation.

The spawn of *Doris* is long and ribbon-like, one fourth of an inch wide. The eggs are arranged in regular rows at right angles to the long axis of the spawn mass.

Aeolis papillosa lays about forty separate, oval, salmon-colored egg masses, all of which are united into one large, gelatinous mass.

Death-feigning in Sand Fleas: S. J. HOLMES, Ann Arbor, Mich.

Death-feigning in the large sand-flea, *Talorchestia longicornis*, is a pronounced instinct. This species is nocturnal in its habits, and during the day lies curled up in its burrows in the sand in a condition apparently much like the sleep of higher animals. When dug out of its burrows, *Talorchestia* may remain curled up and motionless, or it may assume such a condition after a few hops in the sand. In assuming the death-feigning attitude, *Talorchestia* flexes its body, draws up its legs, and bends its antennæ under the thorax. It will then remain motionless, often for a long time, and may usually be picked up without betraying any evidence of animation. The utility of such an instinct is obvious, as it enables its possessor to

escape detection. By lying quiet in the sand, which it closely resembles in color, *Talorchestia* would easily be overlooked by predatory birds and mammals, whereas if it endeavored to escape by hopping away, its large size would render it an easy victim.

The terrestrial amphipods form a group which has only recently adopted the habit of living upon land. The instinct of death-feigning is, therefore, one of recent origin, as it is one which has doubtless been acquired in adaptation to the habit of living above water on sandy beaches. We naturally look to the behavior of the aquatic relatives of this species and of other terrestrial forms for light upon the origin of this instinct. Two other species found on the New England coast, *Orchestia palustris* and *O. agilis*, fortunately exhibit intermediate modes of behavior which connect the death-feigning instinct of *Talorchestia* with the so-called thigmotactic reactions of the aquatic amphipods. Nearly all the littoral species of aquatic amphipoda manifest a strong propensity to keep in contact with solid objects. When free from contact they are restless. They usually endeavor to insinuate themselves between objects, so as to secure a maximum of contact; then they lie quiet, usually with the antennæ bent back and the body flexed.

The behavior of the two species of *Orchestia* studied shows that they possess certain fundamental features of conduct in common, and that the death-feigning of *Talorchestia* is nothing but an exaggeration and specialization of the thigmotactic proclivity which these forms share with the aquatic amphipoda.

Variation and Natural Selection in Lepidoptera: H. E. CRAMPTON, Columbia University.

The relation between the process of

elimination and variation in *Philosamia cynthia* was first considered. It was shown that pupal elimination is directly related to variation, selection being 'secular' (with reference to type) as well as 'periodic' (with reference to variability). *Samia cecropia* exhibits only periodic selection. Reproductive selection appears clearly in *Samia cecropia*.

The Tortugas as a Biological Station for Research: ALFRED G. MAYER, Museum of the Brooklyn Institute of Arts and Sciences.

The Tortugas occupy what is probably the most favorable situation from which to study the tropical life of the Atlantic Ocean. Extensive coral reefs surround the islands, and in the immediate neighborhood one finds reef flats, sandy bottoms, coral mud and a great variety of habitats for a rich and varied fauna. Pure deep ocean water surrounds the group, and their separation from the Florida coast is sufficient to prevent the impure water of the mangrove swamps from contaminating the ocean water of the Tortugas. It is, therefore, possible to maintain larvæ alive for many weeks in aquaria. The temperature of the surface waters in the immediate vicinity of the Tortugas is remarkably high, being from 74° to 77° in winter and 80° to 86° in summer. It is, therefore, warmer than any other part of the Atlantic Ocean, excepting the Bight of Biafra, and is almost identical in temperature with the waters surrounding the Fiji Islands. The northern edge of the Gulf Stream lies about twenty-five to thirty miles south of the Tortugas, but the prevailing easterly and southerly winds of the spring and summer months drive the surface waters of the Gulf Stream upon the shores of the Tortugas, thus drifting in great numbers of pelagic animals, which cause the surface tows to be richer in this

region than at any other place known to the writer, and comparable only to the condition observed in the region of the Kuroshio, in the neighborhood of the Philippine Islands.

The pelagic fauna of the Tortugas contains representatives from the coast of Africa and from the entire tropical Atlantic, and is in general remarkably similar to that of the Fiji Islands, although specific distinctions between related forms of Fiji and Tortugas can usually be determined. This close relationship is probably due to the similarity of the temperature and the conditions of the reefs.

The fauna of the Tortugas is strictly tropical. Its special advantages over any station on the Florida coast are purity of the water and the richness of the fauna. In these it appears to be superior also to the West Indies, the Bahamas, and very much richer than the Bermudas. The climate is healthful, and although in the summer months the humidity is very great, it is possible to maintain perfect health and energy throughout the hot season. The recent establishment of a naval coaling station at the Tortugas has made it easily accessible from Key West.

The Phasmidæ, or Walking-sticks of the United States: A. N. CAUDELL, U. S. National Museum. To be published in *Proc. U. S. Nat. Mus.*, Vol. XXVI., 1903.

This paper gives, in monographic form, tables for the separation of the Phasmidæ into subfamilies, genera and species, only the forms of North America north of Mexico being included. A few prefatory paragraphs are given bearing upon the nature and habits of the species composing the family. Four subfamilies are recognized, one, Timeminæ, being described as new, based upon a very remarkable forficulid-like form from California. Three genera and as many species are described

as new and one species, *Timema californicum*, first mentioned by Professor Scudder some years ago, is here described for the first time. Four plates are given, illustrating species of all the genera.

The Morphology of Clasping Organs in Certain External Parasites: HERBERT OSBORN, Ohio State University.

The adaptations of parasitic animals afford numerous striking cases of structural specialization, and in this paper certain highly modified organs for adherence in Pediculidae are described and their homologies discussed. In *Hematopinus urius* there is a protractile disk on the distal end of the tibia, which from its position must be applied to the hair opposite the tarsal claw. In *Hematopinus macrocephalus* an organ in the same position has more convex membranous surface, and distinct internal muscles. In both the disk and the spines on its border evidently arise from the chitinous wall, but their musculature is problematic. In *Euhematopinus abnormis* the posterior legs are greatly modified, the femur and tibia each with expanded disk, the former opposed to the middle femur and the latter to a special structure in the margin of the abdomen, both evidently serving to strengthen the grasp on hairs or fur, or to give greater rigidity in position. Other special structures are noted in antennal joints, in abdominal brushes, ridged tarsi, etc.

Description of Four New Species of Grasshoppers, and Notes on Other Orthoptera from Colorado, Texas, Arizona and New Mexico: A. N. CAUDELL, U. S. National Museum. To be published in *Proc. U. S. Nat. Mus.*, Vol. XXVI., 1903.

This paper treats of more than 150 species of Orthoptera, mostly collected in

Colorado during the summer of 1901 by Dr. H. G. Dyar and the writer, though species from the other states mentioned in the title are included. The location and altitude of the various places visited in Colorado are given, and every species taken is listed, if only for the value attached to records of exact locality. Many of the species are represented in considerable numbers and thus present opportunities for studies in variation. Four new species are described, and two species of Blattidae are recorded for the first time from the United States. One plate is given, comprising figures of the new species.

An apparently unrecorded fact regarding the large lubber grasshopper of the South, *Dictyophorus reticulatus* Thunberg, is noted. Both sexes of this brightly colored insect make a distinct simmering or bubbling sound when disturbed. This sound was found to proceed from a gland, probably a modified spiracle, opening from the side of the body above and slightly behind the middle coxa. The sound is made by the insect's forcing out very minute bubbles of a clear liquid with sufficient force to cause a sound capable of being heard for some distance. Whether this liquid has repelling properties and the resulting sound is purely mechanical, or whether the production of sound is the object of the mechanism, was not determined. The conspicuous warning colors of the insect would rather indicate the former supposition.

The Colorado collection seems to indicate the existence of but three faunal zones in that state instead of four, as indicated by the lepidopterous fauna as pointed out by Dr. Dyar in the *Proceedings of the United States National Museum* (XXV., 369, 1902). The Orthoptera show no distinct indication of a separate faunal zone on the western slope.

A Review of Certain Attempts to Introduce the Eastern Oyster into the Bays on the Oregon Coast: F. L. WASHBURN, State Entomologist, St. Anthony Park, Minn.

Encouraged by the reported finding of eastern spat in abundance in San Francisco Bay in 1890, it was resolved by the state authorities in Oregon in 1896 to attempt to induce the eastern oyster to propagate in the bays of the Oregon coast, and to that end an appropriation was secured in the legislature, as was also the cooperation of the United States Fish Commission. The work was in charge of the state biologist. In 1896 twenty-two barrels of two-year-old oysters, and in 1900, ten barrels, were shipped from New York state. The first of these consignments was on the road twelve days, and the second eight days, but the oysters nevertheless arrived in excellent condition, the loss not exceeding a fraction of one per cent.

Various means were resorted to to make a success of the experiment. The oysters were placed upon a portion of ground which is a natural bed for the native northwest coast oysters, and where abundance of food could be obtained. Artificial fertilization was practiced and millions of fertilized eggs were poured into the bays at different times. Oysters were placed in floats and artificial ponds, and in cemented tanks; in fact, nothing was left undone which was within the power of the biologist. Little or no results came from these experiments. The strong, cold northwest wind which prevails almost every day in summer on the northwest Pacific coast not only chills the surface of the water of the bays, but appears to force into all the inlets an immense amount of ocean water which has an average summer temperature of about 55° F. and a salinity of 1.025. The water in all the bays of Oregon is quite cold on the flood tide, the

writer having seen it change from 70° F. and a density of 1.016 at low tide to 57° F. and a density of 1.022 at high tide within six hours, and this at a distance of seven miles from the ocean. These conditions of temperature and salinity and such marked changes are all unfavorable for the developing spawn. Only one or two specimens have been found which were undoubtedly hatched on that coast.

Although these experiments in propagation were a failure, the transplanted oysters attained an immense size in a short time, and were all of such excellent quality that the importation and fattening for sale of eastern oysters in the markets of the northwest coast offer inducements to capital.

Some Recent Cytological Investigations in their Bearing on Mendel's Principles of Heredity: E. B. WILSON, Columbia University.

Abstract of this paper has appeared in SCIENCE, N. S., XVI., No. 416, December 19, 1902.

Provisional Program for Continuation of Researches on Cave Fauna: C. H. EIGENMANN, Indiana University.

A Reconnaissance of Faunal Conditions in Jamaican Waters: HUBERT LYMAN CLARK, Olivet, Mich.

Report of a recent visit to Jamaica, including: (1) Observations of echinoderms, (2) variation in the genus *Stichopus*, and (3) an apparently new parasitic turbellarian.

The three preceding papers were read at a joint session of Section F and the American Society of Zoologists.

On a Small Collection of Crustaceans from the Island of Cuba: WILLIAM PERRY HAY, Howard University, Washington, D. C. To be published in *Proc. U. S. Nat. Museum.*

The paper contained notes on a collection of crustaceans from the caverns and coastal streams of Cuba submitted to the author by Dr. C. H. Eigenmann, of the State University of Indiana. There are altogether fourteen species, of which three—*Cirolana cubensis*, *Palæmonetes eigenmanni* and *Palæmonetes cubensis*—are new to science.

Cirolana cubensis and *Palæmonetes eigenmanni* are spelean species exclusively and have the usual characteristics of such forms—they are slender, transparent and blind. Full descriptions and figures of the new species were given. Under the notes on *Cambarus cubensis*, attention was called to some rather unusual characters shown by the specimens collected by Dr. Eigenmann which may by future work be shown to mark a distinct species.

The collections were made in the early spring of 1902, through the assistance of a grant of money by the American Association for the Advancement of Science.

Evolution of the Proboscidea in North America: H. F. OSBORN, American Museum of Natural History, New York city.

From the oldest certainly known form, *Palæomastodon* of Egypt, through the Lower Miocene *M. angustidens* of Europe, the Proboscidea migrated to America. In the Middle Miocene at least three and possibly four contemporary phyla appear in this country. The first phylum, distinguished (1) by laterally compressed upper tusks, (2) short lower tusks, (3) narrow molars with a single trefoil, includes the Middle Miocene *M. productus* Cope and the Upper Miocene and Pliocene *M. floridanus* Leidy, *M. obscurus* Leidy, *M. tropicus* Cope, *M. serridens*, *M. rugosidens* and possibly *M. precursor* Cope. The second phylum, with (1) round upper tusks and (2) a double trefoil on long narrow molars, includes the Upper Miocene *M. cam-*

pester Cope and possibly *M. humboldtii* of South America, a Pliocene or Pleistocene form. The third phylum, distinguished by (1) long lower tusks, with enamel in the early stages, (2) laterally compressed upper tusks, (3) short posterior molars, includes *M. brevidens* Cope (the oldest species known in North America), *M. euhypodon* Cope from the Upper Miocene and possibly *M. sheppardi* Leidy from the Pliocene. In the Pliocene appears the highly specialized *M. (stegodon) mirificus* Leidy, with (1) round upper tusks, (2) double trefoil, (3) only four grinding teeth altogether. This may connect with the *M. campester* series, or it may represent a new arrival from Europe. The early Pleistocene includes two superb elephants, *E. columbi* of the Middle and Southern States, and *E. imperator* of the Southwest. Both these species can now be clearly distinguished from the true northern mammoth, *E. primigenius*. The paper is illustrated by numerous drawings and photographs. Acknowledgments were made especially to Mr. F. A. Lucas.

Primary Division of the Reptilia into Two Great Groups Phylogenetically Distinct:

HENRY F. OSBORN and J. H. MCGREGOR, Columbia University. Presented by Henry F. Osborn; will be published elsewhere.

Some Questions as to the Arrangement of the Primates: B. G. WILDER, Cornell University.

This paper embraces four parts:

(a) A provisional dichotomous arrangement of the Primates in which the main stem, terminating in man, gives off branches representing successively the lemurs, the marmosets, the New World monkeys, the Old World monkeys, the gibbons and the giant apes. Of this last group one subdivision includes the two African apes, the gorilla and chimpanzee,

and the other the orang. The general principle of dichotomy was followed by the author with respect to the entire animal kingdom in a paper before this association in 1887, and is believed by him to be equally applicable to the primate order.

(b) But questions and difficulties arise in connection with all the divisions. For example, the extinct *Pithecanthropus* is not included, and there is no hint of the possibility of a closer affinity between *Tarsius* and the tailless apes. As to the latter, the less divergence of the gibbons from the tailed monkeys has been urged by Chapman, but he regards the gibbons and orang as 'closely related,' whereas the present arrangement, mainly on cerebral grounds, places the orang nearer man than either the gorilla or the chimpanzee.

(c) The author believes that, eventually, all the divisions and subdivisions may be based upon encephalic characters alone, but at present, even where the brains are recognizably different, it is not always possible to formulate the distinctions.

(d) In order to determine the validity of this belief, it is necessary to compare the brains of all genera and if possible all species, and several of each. One of the author's graduate students, Mr. T. L. Hankinson, spent most of last year in the effort to determine the fissural differences between the Old and New World monkeys, but his appointment to a college position has interrupted the work for the present. Among the genera of which more examples are desired are *Hylobates*, *Nasalis*, *Semnopithecus*, *Colobus*, *Brachyteles*, *Pithecia*, *Brachyurus*, *Nyctipithecus* and all lemurs.

Male Preponderance (Androrhropy) in Lepidopterous Insects: A. S. PACKARD, Brown University.

Eimer ('On Orthogenesis,' etc., 1898) calls attention to what he calls the 'law of

male preponderance,' or the fact that the male is ordinarily a step or so in advance of the female in expressing the direction of development, and then transmits in a certain measure his characters to the species. This, he adds, may occur exceptionally in females, so that there is a law of female preponderance. He takes his examples from the markings of *Papilio*, of lizards and of birds of prey.

There are numerous cases among other lepidoptera than butterflies. Male preponderance, as we understand it, is a general law of animal life. The female is the conservative sex, the male, as is well known, the more variable, the more active and aggressive, and the founder of new structures or markings characterizing new varieties and species.

For the principle of male preponderance we would propose the term *androrhropy* (*ἀνδρεῖος*, male; *προνή*, preponderance), and when female preponderance exceptionally occurs, it might be called *gynerhropy* (*γυνή*, female; *προνή*, preponderance).

Very obvious examples of androrhropy occur in the Saturniidæ. In this group the females have aborted mouth-parts, they are very heavy and sluggish, inactive, flying, if at all, but a short distance from their birthplace. On the other hand, the male is more active and energetic, will fly for miles in search of the female, guided by the odor emanating from her body. The male is thus exposed to a greater variety of environmental conditions. An example is seen in the genus *Saturnia* (i. e., *S. pavonia-minor*) of male divergence from the form and markings of the female; otherwise gynerhropy prevails in this genus.

In the tailed forms, especially the group represented by *Graëllsia*, *Arzema*, *Actias*, and *Tropaea*, the effects of the inheritance of male characteristics is seen to have af-

fected this whole group. Comparing the two sexes of the primitive form of *Graellsia* with their hind wings briefly tailed, the males have much the longer 'tails.' In *Actias selene* the tails are nearly of the same length in both sexes, but in *Tropaea luna*, perhaps the most recent form of the group, the tails in the male are decidedly longer than in the other sex. In *T. artemis* of Japan there is a tendency to revert to the *Graellsia* form of tail, as they are very short. The principle is seen also in regard to the markings and coloration in general.

From the prepotency of the male of some ancestral form similar to this insect, the tailed forms of the large green moths living in Africa, Asia, and our American *Tropaea luna* may have originated.

Other striking examples of androrhropy are seen in the moths of an allied group (Sphingicampidae), such as *Arsenura*, *Eudelia*, etc. This does not conflict with the apparent fact that the length of the tails of species of *Papilio* seems to depend on temperature, those living in boreal, cool, moist situations, or in cool, damp, elevated, mountainous regions, having the tails much shortened.

The Decapod Crustaceans of the Northwest Coast of America from Alaska to San Diego, California: MARY J. RATHBUN, United States National Museum, Washington, D. C.

This paper, which will be published among the results of the Harriman Expedition, embraces not only the material derived from that expedition, but the collections in the U. S. National Museum which have been obtained in the same region from the work of the U. S. Fish Commission steamer *Albatross*, the Coast Survey and other explorations. It includes a check-list of the Decapoda of the region, figures of many of the little-

known forms, and much new information concerning them, especially as regards distribution.

Further Notes on the Heart of Molgula manhattensis Verrill: GEORGE WILLIAM HUNTER, Jr., New York city.

Research by means of the intra-vitam method of staining with methylene-blue points to a connection between the ganglion cells of the heart and those of the central nervous system. The course of the connectives is as yet not fully worked out.

The following physiological data seem to point to this connection in animals in which the ganglion or dorsal nerve chain is partly or wholly destroyed:

(a) The heart beat (variable within limits) is appreciably slower.

(b) A lack of coordination between the two ends of the heart appears.

(c) There is sometimes great irregularity in the heart rhythm.

(d) The heart beats on occasions for from two to three hours in a given direction without reversal. (The normal heart usually reverses every one to two minutes.)

Certain substances (caffein, muscarine, nicotine, strychnine, *et al.*), heart depressors or accelerators, which are believed to act upon nerve cells or endings in the heart or in the sympathetic system of vertebrates, act in a similar manner upon the normal heart of *Molgula*. In the cauterized animal, however, no such results are obtained.

On the Morphological and Physiological Classification of the Cutaneous Sense Organs of Fishes: C. JUDSON HERRICK, Denison University, Granville, Ohio.

The proper interpretation of these sense organs has heretofore not been possible, because the problem has not been approached with sufficient breadth of view. Taking into account structure, innerva-

tion and function as experimentally determined, we may classify as follows:

I. Organs of the general cutaneous system. Free nerve endings of tactile nerves.

II. Organs of the acustico-lateral system. Peripheral organs neuromasts, with hair cells among indifferent cells, the former extending only part way through the sensory epithelium. Innervation by nerves centering in the tuberculum acusticum and cerebellum. They present the following varieties:

1. Canal organs, regularly arranged in canals in the dermis or dermal bones, which communicate by means of pores with the outside. Function, perception of mechanical jars and maintenance of equilibrium.

2. Pit organs, similar to the last, but each in a separate pit. In lines.

3. Small pit organs, smaller than the last and irregularly distributed.

4. Ampullæ. Organs at the bottom of long slender tubes. Only in Selachii.

5. Vesicles of Savi. Closed vesicles, only in the torpedoes.

6. Cristæ acusticæ. In semicircular canals of all vertebrates. Function, equilibration (reaction to rotary movements).

7. Maculæ acusticæ. In sacculus and utriculus. Function, equilibration (reaction to translatory and static stimuli?) and hearing (?).

8. Papilla acustica basilaris. In organ of Corti. Function, hearing (does not occur in fishes).

III. Organs of the communis system. Special organs with the specific sensory cells extending through the whole thickness of the sensory epithelium. Present in the mouth of most vertebrates and in the outer skin of some ganoid and teleostean fishes. Innervation by communis nerves; primary cerebral centers gray matter associated with the fasciculus communis (= f. solitarius), represented by

the vagal and facial lobes of fishes. Function, taste. Two forms, differing only in position.

1. Taste buds, within the mouth.

2. Terminal buds, in the outer skin, often on barbels or other specialized organs for their reception.

Observations on Footprints in Beach Sand:

HERBERT OSBORN, Ohio State University, Columbus, Ohio.

The observations recorded represent occasional studies during three summers on sand of Cedar Point Beach and adjacent dunes. Photographic records have been secured of as many of these as it has been possible to identify with certainty, and a few others of particular interest or rarity. The camera was adjusted to a vertical position by the use of a brass plate bent at right angles, and the best results were secured in the latter part of the afternoon, when oblique rays of the sun cast strong shadows in the tracks. Lantern slides from the photographic records, including *Hesperomys leucopus*, *Ardea herodias*, *Eurenites pusillus*, *Emys meleagris*, *Coluber vulpinus*, *Heterodon platyrhinus*, *Bufo lentiginosus* var., *Microbembex monodonta*, *Trimerotropis maritima*, *Fontaria indianæ* and *Myrmeleon* sp. were shown and their characters described.

Such records are serviceable in determining the presence of particular animals in a given region, as presenting an interesting feature in the biology of the animal, and as a basis for comparison in studies of the imprints left by extinct animals.

An Exhibit of Lantern Slides Illustrating the U. S. S. 'Albatross' and her Work:

C. C. NUTTING, University of Iowa.

Lantern slides taken by the author during the recent Hawaiian cruise, accompanied by an informal account.

*The Eyes of a Specimen of the Cuban Blind Fish, *Lucifuga*, and those of Her Four Young* (with lantern slide illustrations) : C. H. EIGENMANN, Indiana University.

Faunal Characteristics of the Sandusky Region: HERBERT OSBORN, Ohio State University, Columbus, Ohio.

The Sandusky region as here defined includes parts of Erie, Sandusky and Ottawa counties, Ohio. Practically all the faunal elements of the region are to be found within five miles of the city of Sandusky. A brief summary of faunæ represented and the faunal conditions afforded is given, with illustrations in different groups. The region includes a lowland and partially timbered area of rather rich vegetation and diverse fauna; a beach and sand-dune fauna; a swamp and marsh fauna; a fauna pertaining to rocky coast and island, and one peculiar to a prairie area, approaching plains conditions in scant flora; aquatic faunæ pertaining to bay, coves, river and lake, with abundant plankton, nekton and littoral elements.

Protoplasmic Old Age: GARY N. CALKINS, Columbia University, New York city.

The 'A series' of *Paramaecium* experiments died out December 19, 1902, in the 742d generation. The last few individuals were perfectly normal so far as size, feeding, etc., were concerned. The history of the series tends to the conclusion that there is a definite potential of dividing energy which is possibly connected with a definite substance of the cell—archoplasm or kinoplasm.

The Structure, Development and Function of the Torus longitudinalis of the Teleost Brain: PORTER EDWARD SARGENT, Cambridge, Mass.

Morphology.—The torus longitudinalis, as typically developed, consists of a pair of longitudinal ridges or pads projecting

downward from the thin median portion of the mesencephalic roof and extending from the posterior commissure through the length of the mesencephalon. The form and relative size of the torus, and consequently its relations to the surrounding structures, vary greatly in the hundred or more species examined.

Ontogeny.—The torus longitudinalis is developed from the roof of the mesencephalon as a longitudinal thickening of its median portion. More exactly, each lateral lobe of the torus is differentiated from the mesal edge of the tectum of the corresponding side, the precise mode differing somewhat in the different groups of teleosts.

Finer Anatomy.—Each lobe of the torus has a framework of radiating ependymal fibers. The nerve cells are of relatively small size, and frequently are arranged in parallel rows between the ependymal fibers. The cells are usually bipolar, but ultimately give rise to three sets of neurites. The first forms the tractus toro-tectalis, which runs into the tectum and ends in the superficial fiber zone in contact with the retinal fibers of the optic nerve. Another set of fibers passing out of the torus with the preceding forms the tractus toro-cerebellaris, which courses obliquely around the lateral border of the optic lobe and enters the cerebellum. The third set of neurites forms the tractus toro-fibræ Reissneris, which enters the ventricle in separate fascicles, there becoming united to form the compact fiber tract known as Reissner's fiber.

Function.—The cells of the torus are, then, in connection by their afferent neurites with the endings of the optic nerve, and by their efferent neurites with the body musculature through Reissner's fiber. It is evident, therefore, that the torus longitudinalis is the nerve center for the receipt of those impulses coming in over

the optic nerve which call for quick reflexes.

Homology.—It follows, then, that the cells of the torus longitudinalis constitute a nidulus of cells of common function, homologous with cells of similar function which occur in the anterior dorsal portion of the optic lobes of other vertebrates, and which have been designated as the 'Dachkern,' 'nucleus magnocellularis,' etc.

Phylogeny.—The nidulus of cells which gives rise to Reissner's fiber and constitutes the torus longitudinalis of teleosts is one of the most archaic elements of the vertebrate brain. As an independent structure, however, the torus has its beginnings in the ganoids, resulting from the crowding downward of the nucleus magnocellularis so as to form two incipient longitudinal ridges on either side of the median plane. In the Siluridae, mechanical causes are still operative, but in the more highly differentiated teleosts the torus appears at an early stage of ontogenetic development as the result of phylogenetic causes.

An Unusual Attitude of a Four-weeks Human Embryo. Comparisons with the Mouse: SUSANNA PHELPS GAGE, Ithaca, N. Y. Illustrated by wax models. To be published in the *Journal of Anatomy.*

1. The specimen cut in the membranes shows the body axis lying in two planes at right angles to each other, the torsion occurring in the neck region. The attitude suggests: (a) that the great growth of the heart and the umbilical region on the left may have produced the torsion mechanically; (b) that the pulsations of the heart have produced a passive rotation, or (c) that the rapidly developing muscle cells may already at this early stage have a slight power to produce motion.

2. A very early mouse embryo—that is, with nine myotomes—shows a sharp bend

in the region of the fourth to the sixth myotome, that is, in the cervical region. In the early human embryos so familiar from His' illustrations which show a similar sharp bend and have by some been considered as distorted, the bend occurs in the region of the 12th to the 14th myotome, that is in the dorsal region. In both these human specimens and in the mouse in which no manipulative distortion was possible, the common feature is that the bend is over the opening of the yolk-sac. Rapid growth of the myotomes together with rapid narrowing of the neck of the yolk-sac might in either case produce the condition.

The Cranial Nerves of Squalus acanthias: OLIVER S. STRONG, Columbia University, New York city. To be published in the *Journal of Comparative Neurology.*

The principal object of the research has been to trace the components of the V., VII., IX. and X. nerves. In doing this special attention has been paid (a) to the verification, by study of serial sections, of the results obtained by Stannius, Ewart and others by dissection of selachians; viz., that the canal and ampullary organs are solely innervated by certain special roots and their branches (lateral line component); (b) to the separation of the communis (splanchnic-sensory and end-bud) component, which has not hitherto been done in selachians.

In no case thus far in this research have any branches of the V. nerve been traced to canal or ampullary organs. These organs in the head are innervated solely by the two lateral line roots of the VII. nerve which form the rami ophthalmicus superficialis VII., buccalis VII., mandibularis externus VII. and certain minor branches. The ramus mandibularis externus VII. is apparently derived practically entirely from the more dorsal of the two lateral

line roots, the ramus buccalis receiving the major part of the remainder of this root, while the ramus ophthalmicus superficialis VII. is principally composed of the bulk of the more ventral lateral line root. This would apparently negative the view that the ampullary organs are modified end-buds and the dorsal root an end-bud root.

In accordance with the results of previous investigators, the lateral line nerve of the trunk, which shows some evidence of being really compound, is found to be derived from a special root cephalad of the IX. and X. An interesting point is that the anomalous branch of the IX. nerve to canal organs is in reality composed of fibers derived from a small separate lateral line root.

The communis root of the VII. nerve separates, distal of its ganglion, into a ramus palatinus innervating the roof of the mouth, into certain minor branches, oral and spiracular, and into the ramus mandibularis internus innervating the floor of the oral cavity. The numerous roots of the vagus are rearranged distally to the vagal ganglia into the branchial nerves, which divide into the usual pre- and post-branchial branches, the former containing communis, the latter communis and motor components, the former component innervating the lining of the pharyngeal and branchial cavities. Thus the communis component was found to conform to the general type found in other forms.

A Dissecting Pan and a Substitute for Beeswax: E. L. MARK, Harvard University, Cambridge, Mass. To be published in the *American Naturalist*.

A specimen of the dissecting pan used in the Cambridge laboratories was exhibited and its advantages over those in general use were explained. There was also

described a mixture of mineral and vegetable waxes, which is better and much cheaper than the beeswax usually employed in pinning out objects to be dissected under fluids.

White Feathers: R. M. STRONG, Haverford, Pa.

No white pigments have been found in feathers; the color of white feathers has been explained as due to a total reflection of the incident light from air spaces or bubbles in the feather structure.

White feathers do not differ essentially in structure from gray, brown, black, red, orange or yellow feathers, except that no pigment of any kind is present. Though some of the white comes from the walls of the air-containing medullary cells of the barb, the larger portion is produced by the barbules which have no air spaces of sufficient size to be of any significance. The white effect, as with snow or powdered glass, is dependent upon the small size of the structural elements. These have a large number of surfaces so placed for any position of the eye that the angle of incidence equals the angle of reflection with a maximum reflection to the eye. There is almost no absorption by the unpigmented feather substance, and the amount of light transmitted through the feather from objects behind is so small as to be imperceptible to the unaided eye in the intense reflection of light.

Some Remarkable Fossil Fishes from Mount Lebanon, Syria: O. P. HAY, American Museum of Natural History, New York city. To be published in *Bull. Am. Mus. Nat. History*.

This paper gives an account of three new primitive saw-fishes and of supposed new species of eels which possess ventral fins and a palatoptygoid arch.

The Bones of the Shoulder Girdle of Fishes: THEO. GILL, Washington, D. C.

The most characteristic system of bones of the pisciform vertebrates is manifest in the shoulder girdle, and the classes of selachians and typical fishes, or teleostomes, have been segregated under the name *Lyrifera*, on account of the character of this girdle. The main elements have the form of the ancient lyre and are connected by an inferior symphysis. In the selachians the lyriform pieces are simple cartilages with which the basal elements of the pectoral fins articulate. In the teleostomes dermal bones are added to the cartilaginous pieces. The cartilaginous pieces remain such in the dipnoans, crossopterygians and ganoids. In the ganoids and especially the sturgeons, an arch is developed. In the teleosts ossification supervenes and a disintegration of the structure results in three independent bones on each side. These bones have been variously named, and by the old anatomists were considered to be homologues of the arm and forearm—humerus, radius and ulna. The view of Gegenbauer, that the principal ones represented the scapula and coracoid, has been accepted by all recent ichthyotomists except in America. The consideration of the history of the nomenclature of osteology and the development of the bones, however, militate decidedly against the acceptance of such a view. Scapula and coracoid were given originally to the composite bone and its process familiar from manifestation in man and all eutherian mammals. The bones of fishes to which the names have been given are certainly not homologous, and consequently the application of the names is very misleading. These bones, in fact, are only developed as such in fishes specialized as teleosts and very remote from the primitive stock of the terrestrial vertebrates. A special nomenclature is therefore necessary for the bones of fishes. The so-called scapula has been designated as *hypocoracoid*, the

coracoid as *hypocoracoid* and the Spangenstück or precoracoid as *mesocoracoid*. The mesocoracoid disappears in most fishes, all the acanthopterygians and offshoots from that stock being deprived of that ossicle. The modifications of the shoulder girdle and its several constituents afford excellent characters for taxonomy.

The Systematic Relations of the Fish Genus Lampris: THEO. GILL, Washington, D. C.

Very recently the foremost ichthyologist of Europe, Dr. Boulenger, has reexamined the osteology of *Lampris*, and especially the shoulder girdle, and has attained novel conceptions as to the affinities of that genus. The number of bones in the shoulder girdle of *Lampris* is the same as in ordinary acanthopterygian fishes, but two of them have been interpreted from a different standpoint than by his predecessors: (1) The very large bone which occupies the lower and posterior part of the girdle was considered by him to be a peculiar bone, named interclavicle, and homologized with a homonymous bone of the hemibranchs, and (2) the smaller one immediately above it and behind the bones supporting the pectoral fin was regarded as a 'coracoid' or hypocoracoid. Therefore Boulenger removed the genus from all connection with the scombroideans, near which it had always been assigned by previous ichthyologists, and found for it a place near the hemibranchs. In short, he considered *Lampris* as the representative not only of a peculiar family (Lampridæ) but of an independent higher group named Selenichthyes and coordinated with the Hemibranchii and Lophobranchii; the three being associated together as representatives of a suborder to which the new name Catosteomi was given.

The conclusions thus enunciated are so startling and the authority so great that

the skeleton of *Lampris* was submitted to renewed examination. That examination forced the speaker to acceptance of the ideas of the older ichthyologists, rather than those of Boulenger; the four actinosts, or pterygials, of acanthopterygian fishes are recognized, and the coracoid of Boulenger is identified with the fourth actinost. The hypocoracoid is found in the great posterior bone called interclavicle by Boulenger. Thus the normal structure of an acanthopterygian fish is recognized. As a consequence, the genus is restored to the group of acanthopterygiants. The forms and proportions of the principal bones of the shoulder girdle are nearly paralleled by undisputed acanthopterygiants and relatives of the scombroideans—the Caproidæ or Antigoniidæ. Nevertheless, the differences between *Lampris* and all other fishes, as Boulenger has shown, are sufficiently great to entitle it to rank as the type of not only a distinct family (Lamprididæ), but a special superfamily (Lampridoidea).

C. JUDSON HERRICK,
Secretary.

SECTION G, BOTANY.

THE meetings of Section G of the American Association were held in Lecture Hall No. 1, on the first floor of the Columbian University Medical School. Sessions were held Tuesday morning, Tuesday afternoon and Wednesday morning, December 30 and 31, 1902.

The abstracts of papers presented are as follows:

Range of Variation in Eutypella glandulosa (Cke.) E. & E.: C. L. SHEAR, Department of Agriculture, Washington, D. C.

Eutypella glandulosa is a pyrenomycete growing on dead *Ailanthus glandulosus*. Specimens recently collected at Washington illustrate well the variability which

may be expected in various parts of the plant and the conditions which seem to influence it. The parts most variable are the stromata, perithecia (number and shape) and ostiola (length and character of mouth). The stroma is sometimes almost entirely wanting, at other times well developed and conspicuously pulvinate. The perithecia vary in number from one to forty, and in shape from globose to pyriform, with all sorts of irregularities caused by pressure against each other. The ostiola are sometimes scarcely discernible, while in some specimens they reach 5 mm. in length. The tips are normally quadrisulcate, but in the long examples they are frequently acute and smooth. The asci and sporidia appear most constant, showing no corresponding variation in the extreme specimens noted. The variations found seem directly connected with the supply and the manner of supply of moisture during the development of the fungus; the maximum extreme in size and number of parts occurring where the branches bearing the plants were lying in a low place, and were more or less covered with matted grass. It is very desirable to determine the parts most variable and the range of variation in order to segregate correctly the different species in this as well as in other genera of pyrenomycetes.

Antithetic versus Homologous Alternation: DOUGLAS H. CAMPBELL, Stanford University.

Bryophytes have left scanty fossil remains, hence their relation to other forms must be deduced from comparative morphology. This discussion will concern itself with a single class of pteridophytes—the ferns. Antithetic alternation assumes that the sporophyte of the ferns is an elaboration of some bryophytic sporogonium; homologous alternation assumes that bryophytes and pteridophytes are not

genetically related. The homologous theory, based upon (1) the alga-like protallium of certain ferns, together with (2) apospory and apogamy. The objections are (1) the alga-like protonema is almost certainly of secondary origin; (2) apospory and apogamy are readily explicable in other theories. The most primitive ferns have the least alga-like gametophytes. The numerous resemblances in both gametophyte and sporophyte point to a common origin for bryophytes and pteridophytes. Gametophytes are always aquatic: sporophytes are distinctly terrestrial structures. The evolution of the sporophyte is demonstrated by a series of liverworts. The sporophyte of bryophytes culminates in *Polytrichum* and *Anthoceros*. The sporogenous function becomes subordinate and vegetative tissues become highly developed. The uniformity in spore production is one of the strongest arguments for the common origin of archegoniates. *Anthoceros* resembles most closely the hypothetical primitive pteridophyte. The sporophytes of bryophytes and pteridophytes show many points of agreement, besides being an asexual generation derived from the oospore. Those resemblances probably represent true homologies. Objections to considering apogamy as a reversion are that apogamy occurs almost always under abnormal conditions, and in highly variable and specialized forms. Lang's hypothesis of the origin of the sporophyte is not sustained by the actual behavior of the gametophyte exposed to the assumed conditions, shown in various California liverworts and ferns. Coulter's theory as to the importance of photosynthesis in determining the origin of the leafy sporophyte is not impaired by the facts. The development of special green organs is not necessarily associated with terrestrial plants. Apospory and apogamy

are analogous to adventitious budding. The water supply is the prime factor in the development of the sporophyte.

Specific Differences in the Wood of Elm Trees: W. J. BEAL, Agricultural College, Mich.

The wood must be examined from a number of trees of any one species and from several places in each tree. The most reliable differences may not be the same in all genera. In elms, the number of rows and the size of open ducts, the thickness of the cell walls and the proportions of the medullary rays, are all important in determining the species.

Some Undescribed Structures in Synchytrium decipiens: F. L. STEVENS, West Raleigh, N. C.

Several structures of problematic function in the nucleus and cytoplasm of the *Synchytrium* cell are described and figured. They are developed in connection with nuclear division, although their entire divergence from any previously described cytological structure renders an attempt at exact interpretation hazardous. (Illustrated by a plate and lantern slide.)

On the Manipulation of Sections of Leaf Cuticle: S. M. BAIN, University of Tennessee, Knoxville, Tenn.

The author outlines his experience in handling leaf sections with special object of determining thickness of cuticle. His method is to imbed in paraffin, cut with blade of microtome knife in slanting position and unroll scrolls on drop of distilled water on slide. Preparations are then set aside and water is allowed to evaporate at room temperature. The sections are thus attached by simple adhesion to the glass, the whole process being a modification of the method of Nussbaum. Where many

sections are to be made simply to study the cuticle, the best plan is to remove the epidermis from the leaf before passing into reagents. Double staining with haematoxylin and Sudan III. is recommended for photomicrographic purposes.

Suggestions Relative to Botanical Periodicals and Citations: W. A. KELLERMAN, Ohio State University, Columbus, Ohio.

Since botanical periodicals have become numerous, it is considered desirable and practicable that there should be greater specialization, and especially that contributors should offer their manuscripts to those substantial journals which most distinctly represent the phase of botany concerned. If authors would thus generally discriminate according to the nature of their copy, existing and more or less specialized periodicals would become more valuable to the class of readers to which each principally appeals. Opportunity would also offer for additional magazines distinctive in character and definite in scope.

Ready and accurate citation would be enhanced if publications always bore simple, short and correct titles. Proper running head-lines are indispensable. They should contain (left page) page number, name of publication and volume number (also series if any), and (right page) date, subject (or author and subject) and page number, in order just named. No number of part (if any) should appear in headline; it should only appear on cover-page.

The rules for citation adopted by the Madison Botanical Congress should be amended in several respects—the more important being that section which requires the use of the illy understood and scarcely suggestive abbreviations for the months, such as F., Ja., Ag., O., N. and D.; the well-established abbreviations are generally used and should be sanctioned by rule.

Origin of the Patagonian Flora: PROFESSOR GEO. MACLOSKIE, Princeton, N. J.

The Patagonian flora (including that of southern Chili and the islands) contains about 2,100 species and 300 good varieties of phanerogams already described, belonging to 522 genera and 110 families. The Gramineæ have 276 species with 50 varieties, and the Compositæ about 400 species. They are chiefly derived from the Andean region; fewer from Argentina; with minor but significant contributions from Australasia, New Zealand and the Antarctic islands. Papers of Gray, Hooker and others about the North American flora are here amended so as to suppose a migration southwards on the advent of cold periods, sending to Australia and southern Chili, as far as Fuegia, forms which had been previously derived from the Arctic lands; also so as to consider the flora of the Northern Hemisphere and the Oregon-Cordilleras of North America as not primitively Scandinavian, but rather from Central Asia, whence they have radiated in all directions. This explains some of the affinities between the flora of Patagonia and that of Australia, New Zealand, Japan, etc. Besides this, there are evidences of direct transfer of plants between Patagonia, New Zealand and Australasia, by either sea or currents of air; and probably there was at one time, not a land-continuum, but a chain of islands such as would result from the elevation of the Cordilleras towards the south, and consequent emergence of elevated regions in the direction of South Shetlands and of parts towards the south pole. Victoria Land, beyond the south pole, with its volcanoes, may be part of this Cordilleran extension, and other fan-like expansions are traceable.

There are so many isolated and characteristic forms in Patagonia and neighboring parts as to indicate that it is a true

botanical region, although not closely limited from the adjacent lands. In this respect it contrasts with the Arctic regions, which have few peculiar forms. We may cite among its characteristic forms species of *Hamadeyas*, *Chusquea*, *Philesia*, *Lapageria*, *Chloræa*, *Arjona*, *Iodina*, *Acæna*, *Patagonium*, *Schinus*, forms of *Verbena*, *Pernettya*, *Benthamiella*, *Acicarpha*, *Azorella*, *Nassauvia*, *Perezia*; also remarkable cases of discontinuity as *Drimys* and *Veronica elliptica*.

Nuclear and Cell Division in Diplophrys stercorea Cienk.: EDGAR W. OLIVE, Harvard University, Cambridge, Mass.

Diplophrys stercorea is an organism belonging to the Labyrinthuleæ, a group on the border line between the plant and animal kingdoms. It passes through two stages in its life-cycle—a vegetative stage in which the spindle-shaped individuals live separate and distinct from one another and a resting stage in which many individuals crawl to definite centers and there heap up in stalked, orange-colored colonies, visible to the naked eye. During the active vegetative state, the naked cells creep about over a nutrient substratum, being probably propelled by the extremely delicate, fine pseudopodia which they bear at the almost opposite poles of the spindle. The individuals in this condition each contain usually one yellowish oil body, which lies in the cytoplasm close beside the nucleus and which breaks up into minute granules during active movement or during nuclear division. The nucleus, which is plainly visible in the living organism, is of simple type, consisting of a single spherical chromatin mass, or karyosome, surrounded by karyolymph, the whole enclosed within a membrane. During nuclear division, the karyosome divides by simple constriction into two equal parts. Division of the naked spindle-shaped cell

results from the progressive cleavage of a fission plane, which starts at one side and travels transversely across the cell at an oblique angle. This oblique plane of fission is unusual, since longitudinal or transverse fission is the rule among unicellular forms. The oil bodies are equally represented in the two daughter cells, and in the subsequent resting condition they usually become aggregated into one refractive yellow mass.

On the Behavior of Certain Yeast Organisms in Pure and Mixed Cultures: WM. B. ALWOOD, Blacksburg, Va.

This paper treats briefly of the physiological activities of yeast organisms isolated from the fruits of apple, and then sown as pure and also as mixed cultures in an apple must of known chemical composition. The results obtained are illustrated by two graphic charts.

The Desert Botanical Laboratory of the Carnegie Institution: D. T. MACDOUGAL, New York Botanical Garden.

A notice in regard to this laboratory has already been published in SCIENCE. Dr. MacDougal stated in greater detail the purposes and scope of the laboratory. President Gilman, Professor McGee, Professor Toumey and others took part in the discussion.

The Pines of the Isle of Pines: W. W. ROWLEE, Ithaca, N. Y.

A taxonomic discussion of the West Indian hard pines and a comparison of them with the species of the Gulf states.

A new species, *Pinus recurvatus*, is described and commented upon. The ecological significance of the dense summer wood of these species is ascribed to the xerophytic conditions under which the plants exist. Specimens and photographs were used to illustrate the paper.

Studies in Araceæ: DOUGLASS H. CAMPBELL, Stanford University.

The material was collected at Kew. The species especially studied were *Aglaonema commutatum* and *Spathicarpa sagittæfolia*.

Aglaonema commutatum shows extraordinary variation in the development of the embryo-sac. The ordinary angiospermous type was never found. The number of nuclei in the mature sac is probably, in most cases, eight, but may be as many as twelve. A definite egg apparatus and antipodal cells are rarely met with, and the former is rarely at the micropylar end of the sac, but usually lateral in position. Three or four nuclei are often found in process of fusion, presumably as a preliminary to the endosperm formation. The formation of the endosperm proceeds from the base of the sac; cell walls are present from the first. The tissues of the young embryo are very little differentiated; at maturity it fills the embryo-sac. *A. pictum* conforms to the ordinary angiospermous type.

Spathicarpa sagittæfolia shows no marked deviation from the angiospermous type except in the great development of the antipodal cells subsequent to fertilization. The nuclei of the antipodal cells attain enormous dimensions. The development of the endosperm is much as in *Aglaonema*. The embryo is small.

A Preliminary Synopsis of the North American Species of the Genus Mitrula: E. J. DURAND, Ithaca, N. Y.

During the last summer species of the genus *Mitrula* were unusually abundant in the vicinity of Ithaca, N. Y. Photographs and full descriptive notes were obtained of so many species (some of which were undescribed) that it seemed desirable to attempt an arrangement of the North American species. A general preliminary synopsis of these species makes up the bulk

of the paper. Further study of material in the large herbaria will be necessary before the paper will be ready for publication.

On a Fungus Disease of the Mulberry Fruit: W. A. ORTON, Department of Agriculture, Washington, D. C.

This paper gives a brief description of a disease of the mulberry in the southern states caused by an undescribed fungus which fills the seed. Specimens of the infected seeds, and also slides and drawings, were exhibited.

Numerical Variation in Plants: JESSE B. NORTON, U. S. Department of Agriculture, Washington, D. C.

A review of past work in this line—Ludwig's work and his approach to a logical explanation of the Fibonacci series of 3, 5, 8, 13, etc., as based on phyllotaxy—other literature—place and time, modes, etc.

The importance of phyllotaxy and anthotaxy in considering numerical variations, illustrated with curves constructed on the variations in numerous plants—*Sanguinaria*, *Chrysanthemum leucanthemum*, *Ranunculus*, etc.

The lack of regularity in phyllotaxy and variation of anthotaxy in individual plants and flowers as a cause of secondary modes in variation curves, illustrated by *Chrysanthemum leucanthemum*, also the relation of the whorled series 1, 2, 4, 8, 16, 3, 6, 9, 12, etc., to the alternate series 1, 3, 5, 8, 13, etc., and its multiples, as giving modes in different species not in perfect accord with the Fibonacci series.

The relation of double curves and individual plants showing tendency toward single curves in individual plants—*Chrysanthemum leucanthemum*—and changes in anthotaxy in individual heads.

The relation of reversed and normal phyllotaxy and anthotaxy to the change

in mode in curves is shown in the pineapple and chrysanthemum.

Transgressive variation due to change of anthotaxy is found in *Iris*.

Contrasts and Resemblances between the Sand Dune Floras of Cape Cod and Lake Michigan: HENRY C. COWLES, Chicago, Ill.

Physically the dunes of these two regions agree: (1) In the character of the sand, except that larger grains are found at Cape Cod; (2) in the general features of dune formation and movement; and (3) in the pronouncedly xerophytic conditions for plant life. The following contrasts were observed: (1) Obscure zonation on the ocean beach (this is much less marked on the bay side of Cape Cod); (2) a vertical sea front on the dunes nearest the sea, doubtless chiefly due to sea encroachment (this feature is wanting at Nantucket); (3) the Cape Cod dunes are much lower, (4) less extensive, and (5) present a much less typical contour; (6) the dune movement is much more rapid on the Cape, as shown by self-registered measurements on half-buried trees.

Ecologically there is general similarity: (1) In the vegetation forms of the two regions; (2) in the wonderful endurance of swamp plants which are encroached upon; (3) in the general content and dynamics of the associations (but on the Cape lichen pioneer stages are often found and pines do not always precede oaks). The contrasts are: (1) The beach flora does not show clear zonation on the ocean side of the Cape, and the plants are huddled at the foot of the fore-dunes; (2) the ocean beach (but not that of the bay shore) has a much sparser plant covering than does the lake beach; (3) half-buried plants show a surprisingly vigorous leaf development on the Cape dunes; (4) the plant cov-

ering on moving dunes is more dense at Cape Cod; (5) tree shapes are less modified on the lake dunes; (6) some species mesophytic in one region are xerophytic in the other.

Floristically the two regions are astonishingly alike, the per cent. of common species being as great or greater than would be true for inland associations at such a distance.

In conclusion, the resemblances are more striking and more far-reaching than the contrasts, showing that halophytic and tidal factors are relatively unimportant in determining sand-dune or even sand-beach floras on Cape Cod. The contrasts which exist are probably due, in the main, to differences in moisture and wind relations. In most respects the Cape conditions seem to be the more severe, and yet the vegetation covering these is more dense and the growth more vigorous.

The Production of New Varieties of Oranges: HERBERT J. WEBBER and WALTER T. SWINGLE.

The great desideratum of the orange industry at the present time is a hardy variety that will be able to withstand the occasional severe freezes without serious injury. The deciduous trifoliate orange is perfectly hardy as far north as Philadelphia, but its fruit is small and practically worthless, though sometimes used for preserves. Several years ago the writers started experiments for the U. S. Department of Agriculture, in the production of a hardy orange by hybridizing the very hardy trifoliate orange with varieties of the ordinary sweet orange. Our aim has been to secure a new hybrid orange that would have the hardiness of the trifoliate orange and the sweet, edible fruit of the common orange. The experiments have not yet been completed, but two hybrids have been secured which possess decided

merit and will be valuable for culture north of the present orange belt.

These two hybrids have fruits about the size of a tangerine orange, varying from two to two and a half inches in diameter. The texture of the pulp is perfect in every respect, the membranes between the segments being tender and the axis very small. They are thin-skinned, very juicy and nearly seedless. Unfortunately, however, they are too sour to be eaten out of the hand without sugar. In flavor they are more like lemons or limes than oranges, but as a matter of fact they stand alone and are like no other fruit existing. They are *new creations* in the fullest sense of the term, like Burbank's plumcots. They are neither trifoliate oranges nor ordinary oranges, though in many characteristics they are strikingly intermediate between these two fruits. Neither are they lemons nor limes, though they will more nearly take the place of these fruits than oranges. The new fruits are very aromatic and have a sprightly acid flavor, with a trace of bitter, which reminds one of the lime and grape fruit. They make a superior ade which rivals lemon or lime ade. They will probably prove to be valuable also for culinary purposes to use in the place of lemons. The trees resemble the trifoliate orange mainly, though having much larger leaves, and will probably prove valuable hedge plants. They are evergreen or semi-evergreen, retaining their leaves the year round in Florida. In more northern localities they will probably lose their leaves in winter. The fruits ripen early and will be gathered before frost. Their hardiness has not yet been thoroughly tested, but young nursery trees have passed through a freeze without losing their leaves or showing any injury, while ordinary oranges beside them were defoliated and twigs the size of one's finger killed.

While the success already obtained is

far-reaching, even more important results will doubtless be obtained when seeds from these fruits are grown and selections made from among the progeny, as it is well recognized that the segregation of characters ordinarily takes place in the second generation of a hybrid.

On the Production of Wart-like Intumescences produced by Various Fungicides:

HERMANN VON SCHRENK, St. Louis, Mo.

Peronospora parasitica appeared in epidemic form on the cauliflower in a greenhouse of the Missouri Botanical Garden. The leaves were sprayed with various fungicides with and without the addition of glue. As a result of the spraying the lower sides of the leaves became covered with large wart-like growths after several days. These were formed by cells of the palisade parenchyma enormously elongated, giving the appearance of oedematous cells. The oedematous condition is supposed to have been caused by a stimulating action of the copper salts.

Evolution not the Origin of Species: O. F. COOK, U. S. Department of Agriculture, Washington, D. C.

Evolution, or progressive change in the characters of species, is a phenomenon quite distinct from the origination or separation of species, and due to distinct causes.

Natural selection and other aspects of environmental influence conduce to the segregation of groups of individuals which have then the opportunity to become different, but the segregation does not cause the differences, which arise through the accumulation of variations assisted by cross-fertilization.

Some Experiments in Cell and Nuclear Division: FRANK M. ANDREWS, Indiana University.

Experiment I., Influence of Hydrogen.
—Young staminal hairs of *Tradescantia*

virginica were put in a three per cent. solution of cane sugar and then brought under the influence of pure hydrogen. Under such circumstances nuclei in the resting stage can not divide, but nuclei which have begun division can complete it. No cell wall is formed; when, however, oxygen is again introduced, a cell wall is formed.

Experiment II., Influence of CO₂.—Nuclear division can not take place in nearly pure CO₂, nor can nuclei which have begun to divide complete the division as stated by Demoer.

Experiment III., Influence of Ether.—No resting nucleus can divide in ether. In one per cent., three per cent., four per cent., five per cent. and six per cent. of ether, nuclei that have begun to divide can complete division and form a cell wall. In seven per cent. ether nuclear division can not take place. Nuclei in ether do not change from indirect to direct division as stated by Nathanson.

Experiment IV., Influence of Cold.—At 2° C. nuclei can divide. At —3° C. or —4° C. nuclei can not divide as stated by Demoer.

Experiment V., Influence of Chloroform.—In chloroform diluted one half with water, nuclei that have begun to divide can complete the division and a cell wall is formed.

Experiment VI., Influence of Ammonium Carbonate.—In a one fourth per cent. or one half per cent. solution of ammonium carbonate, nuclei that have begun to divide can complete division and a cell wall is formed. A one per cent. solution of ammonium carbonate kills the cell in one minute and before nuclear division can advance.

New Examples of Diurnal Nutation: F. L. STEVENS, West Raleigh, N. C.
Nutation similar to that exhibited by

Helianthus is demonstrated by lantern slides for several other genera, prominent among them being *Bidens*, *Amaranthus*, *Ambrosia*, *Medicago*, *Melilotus*, *Artemisia*, *Lespedeza*, *Trifolium*, etc.

Problematic Fossils, supposed to be Seaweeds, from the Hudson Group: DAVID WHITE, Washington, D. C.

Slabs of calcareous shale, deposited in shoal-water flats and marked with mud cracks and iron stains, bear impressions of fragments of supposed algae of singular characters and distinctness. The fossils represent a narrow sinuous axis, now flattened, but probably nearly subcylindrical originally, alternately and repeatedly forked at an extremely wide angle at intervals of 1-2 cm., the subdivisions recurring so as to describe nearly regular and equal incomplete rings or semicircles about 3 cm. in diameter. The lobes, which end obtusely, nearly equal the axis in width, and by their ring-like form and regularity in alternate arrangement present a very striking appearance on the slab. The fossils are true intaglio impressions, or trails, destitute of carbonaceous matter. The structure of the mould bears no evidence of layers or wadding as in worm burrows. They are tentatively regarded as fucoidal and comparable to *Palaeophycus* or *Buthotrephia*, though it is possible that they represent extraordinary trails made by some annelid or other animal organism. The specimens were collected by Dr. Robert Hessler in Fayette County, Indiana.

On Cultures of the Leaf-spot of the Grape, Phyllosticta Labruscae Thm.: A. D. SELBY, Wooster, Ohio.

The paper states the results of successful efforts made at the Ohio Agricultural Experiment Station, to secure the development of the various stages in the growth of this fungus on culture media. Perithecia preceded by pyrenidia were obtained

repeatedly upon agar-agar made from this substance with meat extract and peptone, to which 2 per cent. of grape sugar (glucose) and .03 per cent. tartaric acid were added to approximate the proportion of these substances in ripe grapes. These perithecia contained mature asci and ascospores, and are apparently referable to the same species found heretofore in the old, rotted grape berries and referred to diverse genera—*Physalospora*, *Larstadia* and *Guignardia*. It seems referable to the species known as *Larstadia Bidwillii* Viala & Ravaz.

CHARLES J. CHAMBERLAIN,
Secretary.

THE NEW YORK ZOOLOGICAL PARK AND AQUARIUM.*

THE year 1902 has been a notable one in the history of the New York Zoological Society. The municipality of New York through Park Commissioner Willcox invited the society to take over the direction of the New York Aquarium. This was a mark of strong approval by the city of the management of the Zoological Park by the society. After some deliberation the invitation was accepted, the necessary legislation at Albany was secured, and a contract was made with the municipality whereby the society should receive not less than \$45,000 per annum for the maintenance of the aquarium, and should assume entire control of the personnel and the right to dismiss any of the existing employees, the contract to be terminable on six months' notice on the part either of the society or of the municipality. Mr. Charles H. Townsend, of the United States Fish Commission, was invited to become director of the aquarium. For conference and advice the society appointed a scientific committee including Professor Charles L. Bristol, of New York University, Professor Bashford

Dean, of Columbia, Dr. Alfred G. Mayer, of the Brooklyn Institute of Arts and Sciences, and two other gentlemen. Fortunately, at this time Mr. Townsend was sent abroad by the United States government as expert in connection with the Seal Fisheries dispute with Russia, and this enabled the society to arrange for a complete tour of the aquaria of Europe. Mr. Townsend brought back plans, photographs and notes upon the best features of the foreign aquaria.

The director, with the aid of the advisory committee, has already experimented on a number of important changes in the aquarium, including a new system of labeling and illumination of the tanks. He has also planned the introduction of a fish-hatching exhibit which will be in operation throughout the year, the arrangement for a larger variety of exhibits, especially of invertebrate forms of marine life, the closer touch with the public school system of New York by making provision for supply of material in connection with the biological courses in the schools, etc. Alterations in the aquarium, which will vastly improve the interior, are now being considered at an estimated cost of \$30,000. It is probable that the necessary appropriation will be made, and that by next year the aquarium will be thoroughly well appointed. Fortunately, the design is admirable in all respects except illumination and ventilation, and both these defects can be remedied.

The attendance averages 5,000 persons a day, and the opportunities for spreading a knowledge and love of nature among the people of the city are very great.

THE ZOOLOGICAL PARK.

In the Zoological Park the attendance this year was 731,515, an increase of 38 per cent. or 200,000 over the year 1902. There were 127,000 visitors in the month

* From the seventh annual report.

of August alone. As soon as the rapid-transit system is completed, it is anticipated that the number of visitors will double or treble.

The maintenance provided by the city for the year was \$85,000, but the cost of running the park exceeded this by \$3,500, paid by the society. For the year 1903, owing to the increased area occupied by the park and the addition of several new buildings and installations, the city has provided a maintenance of \$104,965. This is necessary for the care of a park one third as large as Central Park, and of collections now including 2,000 animals, of all kinds. The income from franchises and gate receipts during the year was \$7,000, all of which was devoted to additions to the collections. The membership is at present 1,210; and efforts are being made to increase this to 3,000. In July, 1902, the Board of Estimate and Apportionment appropriated an additional \$250,000 for the improvement and extension of the park. With these funds the system of paths has been increased by a broad walk east of the Bronx River, and another walk through the beautiful portion of the forest known as Beaver Valley, in addition to the erection of the buildings enumerated below. The society is now making application for \$250,000, to be made available July 1, 1903.

The mountain sheep hill has been completed in a most admirable manner under the direction of the head forester, carrying out the general designs of Director Hornaday. The bear dens have been extended to the south, and now complete this series of installations, affording space for every species of this family which can be secured. The collection of bears is already the most complete in existence.

The chief event is the construction of the lion house, at a cost of about \$150,000, from designs by Heins & La Farge, with sculp-

ture by Mr. Eli Harvey, including finely carved sentinel lions, and two pediments, besides a variety of heads in the cornice, of the principal types of the cat family. The feature of this building is the treatment of the interior of the cages with light-green opalite tile, and a frieze of faience tile representing desert and jungle scenes for the lions and tigers, respectively. The director was sent abroad especially to select animals for this building, with funds amounting to \$13,000 donated by individual members of the board of managers. The building will be opened and completely stocked during the month of February.

The antelope house is also well under way, at a cost of \$54,900. This will enable the society to add the African types of quadrupeds to its exhibits in addition to those already shown in the lion house. The bird and ostrich house has been designed for the west side of a new south court, to be named Audubon Court, bounded on the north by the reptile house, on the south by the antelope house, and on the east by the mountain sheep hill.

In addition to the sum of \$25,000 subscribed chiefly for the increase of collections, the park has received some valuable gifts, including an antique Italian fountain, valued at \$25,000, presented by Mr. William Rockefeller; also a memorial gateway to Joseph Lydig, former owner of the forest tract of this park.

During the coming spring the entire southern portion of Baird Court will be put in order, including the lion and the monkey houses, the large sea-lion pool, and the Rockefeller fountain. Plans are also in preparation for extending the eastern portion of the park, and perfecting the southern terminus by a plaza connected with the new rapid-transit system.

One of the most important features of

the year is the establishment of a thoroughly organized medical department under the direction of a veterinarian and a well-known human pathologist. A pathological laboratory is in charge constantly of an assistant, and daily rounds are made by an officer of the medical staff in company with the curators of the respective departments. Full reports are being kept of the symptoms of animals of various types, and of the causes of death. From these records it is proposed to prepare a special work on the habits, care and treatment of animals in captivity. The larger ruminants, especially, are susceptible to gastero-enteritis, and a disappointing feature of the work is the liability to these diseases which has been engendered on the larger ranges. Until the soil and grasses of these ranges have been thoroughly re-treated, it appears that better results are secured by keeping the animals in enclosures than by allowing them free range. After a number of experiments, entirely successful methods of feeding for the prong-horned antelope and for the caribou have been discovered, and these animals are in fine condition. The western varieties of deer, the moose, the buffalo, and to a certain extent the wapiti, are still being studied.

A feature of the management of the park is the appointment of scientific curators instead of keepers in principal charge of the animals. At present the director acts also as head curator of mammals. Mr. R. L. Dittmars has recently been promoted to the full curatorship of reptiles, and assists Mr. Hornaday with the mammals. Mr. C. William Beebe has been promoted to the full curatorship of the birds. By this means a continuous series of observations of the habits of animals is being made and recorded. Mr. Beebe has been especially successful in the rearing of birds, and has made a number of valuable

discoveries in the medical treatment of birds.

The chief publication of the year is by the secretary, Mr. Madison Grant, on the barren-ground and woodland caribou of the northern hemisphere.

Another function of the society has been duly followed during the year, namely, game protection. The secretary has been actively instrumental in connection with the new game laws of Alaska, Newfoundland and British Columbia, and a special fund of \$3,000 has been presented to the society by Miss Stokes, of New York, the interest of which is to be devoted to the protection of birds.

The society has enjoyed the cordial co-operation of Commissioners of Parks of the Bronx and of Manhattan; also the support of Mayor Low and of Comptroller Grout. The relations with all the officers of the city have been of the most friendly character. New York now bids fair to become a model city in the management of its scientific institutions. With Professor Bumpus as Director of the American Museum of Natural History, Mr. Hornaday as Director of the New York Zoological Park, Mr. Townsend as Director of the New York Aquarium, and Dr. Mayer in charge of the zoological division of the Brooklyn Museum, the prospects for the future are extremely bright.

HENRY FAIRFIELD OSBORN,
Chairman of the Executive Committee of the N. Y. Zoological Society.

SCIENTIFIC BOOKS.

Economics of Forestry. A reference book for students of political economy and professional and lay students of forestry. By BERNHARD E. FERNOW, director of the New York State College of Forestry. New York, Thomas Y. Crowell & Co. 1902. Pp. ix + 520. \$1.50.

The appearance of this book is timely, though after many years of forestry propaganda in which its author has taken a prominent part, it may be doubted whether the average student, to say nothing of the layman, is yet fully prepared to appreciate the important principles and conclusions herein enunciated. It is written with characteristic clearness and directness by our greatest authority on the subject, and contains much of vital interest at this stage of forestry development in the United States. This review is an attempt to bring out some of its more salient features, in part in the author's own words. Limits of space unfortunately necessitate great condensation and omission of much that is well worthy of careful consideration.

In his discussion of the relation of the state to natural resources the author considers the principle, recognized in all civilized states, of the necessity of protection of the rights of the many from the unrestricted exercise of individual interests, and extends the principle to its widest interpretation by including the rights of the future many. The activity of the state has for its object the perpetuity of the well-being of society, its continued welfare and improvement; it must provide for the future, must be *providential*, hence the economy of resources, much neglected in economic literature, fully justifies the large place accorded to its discussion. "While we are debating over the best methods of disposing of our wealth, we gradually lose our very capital without even realizing the fact. Whether we have a high tariff or no tariff, an income tax or head tax, direct or indirect taxation, bimetallism or a single standard, are matters which concern, to be sure, the temporary convenience of the members of society, but this prejudicial adjustment is easily remediable. But whether fertile lands are turned into deserts, forests into waste places, brooks into torrents, rivers changed from means of power and intercourse into means of destruction and desolation—these are questions which concern the material existence itself of society; and since such changes become often irreversible, the damage irremediable, and at the same time the extent of available resources becomes smaller

in proportion to population, their consideration is finally much more important than those other questions of the day."

Considering the forest as a resource, it is shown that wood supplies are, and unquestionably will continue to be, an indispensable requirement of our civilization, almost like water, air and food. In the appendix statistics are cited which show that all the industrial nations have, during the last forty to fifty years, increased their per capita consumption of wood materials greatly, in spite of the increase in the use of substitutes. The money value resulting from the mere conversion of the products of our woodlands equals at present annually a two per cent. dividend on the entire wealth of the nation, yet, owing largely to wasteful methods, hardly more than twenty to thirty per cent. of the material in the felled trees is utilized, and by the process of culling the valuable kinds the lumberman gives the advantage to the weeds in tree growth, with no reference whatever to future supplies. In Germany, on the other hand, the forest resource represents, in round numbers, a capital value of \$180 per acre, paying a constant revenue of three per cent. on this capitalization, producing a constant annual gross revenue of \$190,000,000, and this, too, from soils that, for the most part, would otherwise be unproductive. It is apparent that we are bound to exhaust our own stores in less time than they can be replaced, and that we are living not on interest merely, but are rapidly attacking our wood capital. Our per capita consumption is nearly nine times that of Germany, and twenty-five times that of England, a fact that suggests the possibility of a far more economical use of our timber resources.

Under the business aspects of forest production certain striking facts are presented. Thus it is stated that Saxony has taken in about \$200,000,000 during the last fifty years from a small area of rough mountain land, not half a million acres, a tract half the size of many a county in the United States, and that without diminishing, but rather increasing, its earning power. In Prussia the average price of wood per cubic foot nearly doubled in the thirty-five years from 1830 to 1865, and

from 1850 to 1895 it rose nearly fifty per cent. None the less no business realizes more than the forestry business that time is money, and time is what the small capitalist does not have. Since the crop is so long making—75 to 150 years—it is a business for the state and large corporations, rather than for the individual, in most cases.

The natural history of the forest is clearly and instructively discussed in the light of certain well-known factors influencing tree growth, and emphasis is laid on the capital fact that the whole art of forestry, in its technical as well as its financial results, is based upon the knowledge and application of the laws of accretion. The growth of the individual tree, as well as the growth of the whole stand of trees, in quantity and form is subject to laws which can be formulated. The statement of these laws and their application is of much interest, but must be omitted from present consideration, as must the subject of silviculture from its professional standpoint. This latter, however, includes various important suggestions which should be heeded by the would-be reformer, among them measures for reducing the danger from fires.

The chapter on principles and methods of forest policy is one that it will well repay, not only the student, but every thoughtful citizen to read and ponder. It is shown that the forest cover bears a peculiar relation to national prosperity, and that its continuity calls for specially active interest by the community at large, and by its representative, the state. This is apparent when it is considered that the forest is a natural resource which furnishes in very large quantities materials almost as needful as food, and that it forms a soil cover which influences, both directly and at a distance, conditions of water flow, soil and local climate, thereby affecting in a most intimate way the financial, sanitary and social interests of the commonwealth. Since, then, the private capitalist is interested primarily in getting the largest present profit, the care for the future necessarily devolves on the state, and the state must interfere, wherever the interests of the future clearly demand it.

But what form shall this interference take?

The answer, according to Dr. Fernow, will vary according to our conceptions of government functions, according to practical considerations of expediency, and according to the character and location of the forest areas. The exercise of *providential* functions on the part of the state is regarded as a self-evident, logical sequence of the state idea everywhere, but the manner and extent of exercising these functions must vary. In the densely populated monarchical countries of Europe, with relatively scanty resources, a much more direct and strict interference is called for than in a country which has still plenty of elbow room, with plenty of resources; here it may be expedient to leave adjustment to future consideration and action, there expediency calls for prompt and vigorous assertion of state rights and obligations.

But taking conditions and ideas as we find them, it may be accepted as a general principle that as far as forest areas serve only the one object of furnishing supplies, and form the basis of industrial activity, we may, for the present, allow our general modern policy of non-interference to prevail, based as it is on the theory, only partially true, that self-interest will secure the best use of the means of production. There is, however, one great generic difference between the forestry business and all other productive industries, which places it on a different footing as far as state interest is concerned; it is the time element which brings with it consequences not experienced in any other business. In ordinary cases the law of supply and demand coupled with self-interest can be trusted to bring about a proper balance, but in the forestry business, where the time element is so great, the balance of supply can not be maintained in this way; hence even with regard to supply forests the position of the state may properly be a different one from that which it would be proper and expedient to take toward other industrial activities.

This is much more the case when protection forests are involved. Here, in exercising a protective function, the state performs merely the primary logical duty of its existence, namely, securing for each of its members the

maximum opportunity to do for himself, preventing interference, direct or indirect, by others; it is not doing for the individual what he could have done for himself, and is not liable to the charge of paternalism.

There are three different ways in which the state can assert its authority and carry out its obligations in protecting the interests of the community at large, and of the future against the ill-advised use of property by private owners, namely, by exercising educational functions, by restrictive measures, that is police control, and lastly by direct control involving ownership and management by its own agents.

The choice of method in the United States will naturally, and rightly, be in the order named. As a general principle, only when persuasive and promotive measures fail or are insufficient, recourse is to be had to restrictive measures; only when these are inefficient or inexpedient is the state to own and manage properties.

As to educational measures, the author holds that universities have the advantage over special forestry schools and frankly expresses the view that the introduction of the subject into the primary public schools, as advocated by some propagandists, is not desirable nor expedient except incidentally. The endowment of scholarships, however, and the establishment of experimental stations are earnestly recommended, the time element involved in forestry experiments being ample justification of state aid in this direction. The dissemination of statistical information is also emphasized as a means of aiding rational legislation, and the rational conduct of private business as well. These would include estimates of the extent of absolute forest-soils and their cultural conditions, composition, age and character of timber, in short the facts which a legislature needs in order to act intelligently and the private operator must have as soon as forestry advances beyond the stage of mere lumbering.

In considering the attempts that have been made by various state governments to aid private endeavor, particularly by means of bounties, the fact becomes apparent, curiously enough, that paternal methods have found

much more favor and are more extensively used in our country than in European countries, and that these methods, though seldom entirely successful, are still urgently pressed upon our legislators. The timber culture acts of 1873-1874 have proved quite ineffectual, yet as late as 1897 in Pennsylvania, and 1899 in Indiana, the same idea has been embodied in legislation designed for the encouragement of forestry, years after the crude law of the general government had been repealed because of its abuses and lack of satisfactory results. The method of encouragement recently inaugurated by the federal government, namely, to give to private owners specific advice as to the management of forest properties, has much to commend it, though it can hardly be expected that, in the absence of an obligation to follow the working plan, commensurate results will follow.

The taxation of forest property, as now conducted in most of the states, is directly and justly condemned as tending to encourage forest destruction and discourage forest management. The customary method of assessing forest property by including the value of the standing merchantable timber is compared to taxation of farm property assessed not only on the value of land, buildings and machinery, but on the value of the growing crop itself, which would be a most absurd and discouraging procedure. In Wisconsin, for example, taxes on tracts of hardwood lands, from which the pine has been removed, have averaged about ten cents per acre, that is to say, twenty to thirty per cent. of what is probably the year's production must be paid to the tax gatherer. It is safe to say that no other property is so heavily taxed. The natural result is that lumbermen propose to escape from this extortion by stripping the land as speedily as possible, and are not sanguine as to what the state is likely to accomplish in the way of a rational forest policy.

Still worse, perhaps, has been the outcome of tariff regulations, which have resulted in the more rapid cutting of our own forests and the transfer of prosperous industries from the northern states to Canada. Nevertheless, legislation in this direction is not necessarily

pernicious. In Germany there has been protective legislation since 1879, with the result of decreasing importations, but the conditions there and here, where forestry hardly exists as yet, are so different as to render comparisons of little value further than to say that the protection in Germany is given to a well-established forest-management against the competition of exploited natural woods.

The impotency of existing laws designed to prevent forest fires is recognized by every one who has given the matter attention. Under the head of principles to be kept in view when formulating legislation for protection against forest fires the following suggestions are given: (1) There is a necessity of having a well-organized machinery for the enforcement of laws, in which the state must be prominently represented; (2) responsibility for the execution of the law must be clearly defined, and must ultimately rest upon one person, an officer of the state; (3) none but paid officials can be expected to do efficient service; (4) recognition of common interest in the protection of this kind of property can come only by a reasonable distribution of financial liability for loss between the state and local community and the owners themselves.

Passing from restrictive, or police, regulations to the direct supervision and control of forest properties, it is shown that, notwithstanding the necessity of the state's assuming the function of internal improvement in cases of palpable public benefit, as, for instance, in the forcible reforestation of denuded mountain slopes, it is found that control and supervision of private property is an unsatisfactory, expensive and only partially effective method of securing conservative forest management. We are prepared, then, for the conclusion, which seems inevitable, that here, as well as in the old world, it finally becomes preferable in many cases for the community to own and manage forest areas. The ownership may rest either in the state, or in the county, town or other political subdivision which seems most interested in the maintenance of the protective cover, and possession, if it can not be had by purchase, may be obtained by the exer-

cise of eminent domain, a right that may be reasonably exercised when public safety or public utility requires, as is incontestably the case in so many of our states at the present time. In the ideal, most highly organized state, the policy would be for the community to own or control and devote to forest crops all the poorest soils and sites, leaving only the agricultural soils and pastures to private enterprise.

From this clear and forcible presentation of the principles and methods of forest policy the author passes to a résumé of the forest policies of foreign nations, those of France, England (in India), Russia, Austria, Sweden and Norway, and Germany being specially discussed. For the education of the lower class of foresters in Germany and Austria there are some twenty special schools, while for the higher classes not only ten special forest academies are available, but three universities and two polytechnic institutes have forestry facilities. The forests of Germany cover 34,700,000 acres, or 26 per cent. of the entire land surface, a large portion of the forests covering the poorer, sandy soils of the North German plains, or the rough, hilly lands of the smaller mountain systems, and are distributed rather evenly over the entire empire. The condition of the forests depends largely on the amount of control exercised by the state authorities. It is best in all cases in the state forests, it is almost equally as good in the corporation forests under state control, and is poorest in the private forests, particularly those of small holders. In a large part of Prussia, Würtemberg, and Bavaria the corporations provide their own foresters; but these, as well as their plans of operation, must be approved by the state authorities. In Prussia and Saxony private forests are free from governmental interference, but elsewhere in the German Empire private forests are, for the most part, under some state supervision; a permit is required before land can be cleared, devastation is an offense, and in some states a badly neglected forest property may be reforested and managed by state authorities.

From this brief outline it is apparent that

forestry in its modern sense is not a new, untried experiment in Germany, but that care and active legislative consideration of forest wealth date back more than four centuries; that the accurate official records of several states for the last one hundred years prove conclusively that wherever a systematic, continuous effort has been made, as in the case of all state forests, whether of large or small territories, the enterprise has been successful; that it has proved of great advantage to the country, furnished a handsome revenue where otherwise no returns could be expected; led to the establishment of permanent wood-working industries, and has given opportunity for labor and capital to be active, not spasmodically, not speculatively, but continuously and with assurance of success. This rule has, fortunately, not a single exception. It is a highly significant fact, however, that even in Prussia, where the state is exhausting all ameliorative and persuasive means, over 75,000 acres have been deforested by private owners during the last twenty years. The state finally buys these half-wastes, restocks them at great expense, and thus public money pays for public folly in not restricting ill use of forest properties.

It is interesting to note that Japan had a forest policy earlier than any of the European nations, and has now a department of forestry controlling the management of 17,500,000 acres, or thirty per cent. of the total forest area. A forest academy has been connected with the University of Tokio since 1890.

The concluding chapters are devoted to forest conditions and the forestry movement in the United States. An area of 500,000,000 acres represents practically the forest territory of this country capable of timber production, much of it 'culled' forests from which a large part of the merchantable timber has been removed. The forest reservations of the federal government to July 1, 1902, comprise nearly 60,000,000 acres, or about one per cent. of the public domain, including brush lands, grazing lands, and desert. The state of New York owns over one and a quarter million acres and is increasing the area of the state forest, and Pennsylvania has entered

upon the same policy; but in the other states forest property is still almost entirely in private hands. It is not to our credit that conservative lumbering is thus far hardly more than a name in the United States, and in most cases the policy of 'skinning,' *i. e.*, culling out the merchantable timber, prevails. It is, however, a hopeful feature of the situation that corporations and wealthy capitalists are beginning to see the financial advantages of the future in forest properties, that sporting associations are also becoming interested in forest preservation, and that the long period of agitation is finally passing into one of scientific study of our resources, with at least here and there commendable and measurably adequate legislation. It has become at last the policy of the United States government to take care of its long-neglected forest lands, but the administration of the forest reserves is still in an embryonic condition under the General Land Office, while the survey and description of forest reservations are conducted under the agency of the Geological Survey, instead of having the whole matter under the one head, namely the Forestry Bureau of the Department of Agriculture, an anomalous condition of affairs that can hardly prevail much longer.

It need hardly be said that this authoritative exposition of the economics of forestry, with the applications that have been made to present conditions and needs in the United States, can not fail to render most important service at a time when the great majority of intelligent citizens freely acknowledge the pressing necessity of a forward movement, but, in nine cases out of ten, are either hopelessly in the dark or extremely ill-advised as to the steps that ought to be taken.

V. M. SPALDING.

SOCIETIES AND ACADEMIES.

MEETING OF THE CHICAGO SECTION OF THE AMERICAN MATHEMATICAL SOCIETY.

THE twelfth regular meeting of the Chicago section of the American Mathematical Society was held on Friday and Saturday, January 2 and 3, at the University of Chicago. The meeting was presided over by Professor

H. B. Newson, of the University of Kansas. The following papers were read:

DR. SAUL EPSTEEN, University of Chicago: 'Determination of the group of rationality of a differential equation.'

PROFESSOR E. W. DAVIS: 'A group in logic.'

PROFESSOR H. B. NEWSON: 'On the generation of finite from infinitesimal transformations; a correction.'

PROFESSOR L. E. DICKSON, University of Chicago: 'The ternary orthogonal group in a general field.'

PROFESSOR L. E. DICKSON, University of Chicago: 'The group defined for a general field by the rotation groups.'

PROFESSOR A. S. HATHAWAY, Rose Polytechnic Institute: 'Vector Analysis.'

PROFESSOR JAMES BYRNIE SHAW, Kenyon College: 'On nilpotent algebras' (preliminary communication).

PROFESSOR D. F. CAMPBELL, Armour Institute of Technology: 'On homogeneous quadratic relations in the solution of a linear differential equation of the fourth order.'

DR. S. E. SLOCUM, University of Cincinnati: 'Relation between real and complex groups with respect to their structure and continuity.'

PROFESSOR ARNOLD EMCH, University of Colorado: 'On the involution of stresses in a plane.'

MR. R. E. WILSON, Northwestern University: 'Polar triangles of a conic and certain circumscribed quartic curves' (preliminary communication).

PROFESSOR H. S. WHITE, Northwestern University: 'Orthogonal linear transformations and certain invariant systems of cones' (preliminary communication).

PROFESSOR R. E. ALLARDICE, Leland Stanford University: 'On the envelopes of the axes of similar conics through three fixed points.'

The report of the committee appointed at the last Christmas meeting to devise a scheme of uniform requirements for the Master's degree for candidates making mathematics their major subject, was discussed, and portions of it adopted, the remainder being held over for consideration at the next meeting of the section. The report deals with the undergraduate program and suggests a basis for graduate study on the assumption that one year of such study will be required for the Master's degree. Copies of the report may be had from the secretary of the section.

The following officers were elected for the ensuing year:

Secretary—Professor Thomas F. Holgate.

Additional Members of the Program Committee—Professor Ernest B. Skinner and Dr. S. E. Slocum.

The next meeting of the section will be held in April.

THOMAS F. HOLGATE,
Secretary of the Section.

EVANSTON, ILLINOIS.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the 136th meeting of the society, held in assembly hall of the Cosmos Club, Wednesday evening, January 14, 1903, the following program was presented:

Dr. Arthur C. Spencer exhibited some specimens of metallic copper taken from the crevices of an old wall which had been covered for perhaps thirty years by sulphide-bearing débris from the mines at Cobra, near Santiago, Cuba. A calcareous mortar was locally replaced by copper, which now occurs without admixture of any foreign material.

The chemical reactions involved were discussed by Dr. H. N. Stokes, who has recently been engaged in an extensive study of the conditions under which metallic sulphides are deposited.

In a brief review of the history of the work on ore deposits, in America particularly, Mr. S. F. Emmons introduced Mr. W. H. Weed, who proposed a genetic classification of ore deposits, whose major subdivisions are as follows:

I. Igneous (Magmatic segregations).

A. Silicious.

B. Basic.

II. Igneous emanation deposits (deposited by highly heated vapors and gases in large part above the critical point, e. g., 365° and 200 atm. for H₂O).

A. Contact metamorphic deposits.

B. Veins (closely allied to magmatic veins and to division IV.).

III. Fumarolic deposits (metallic oxides, etc., in clefts in lavas; no commercial importance).

IV. Gas-aqueous (pneumato-hydato-genetic) deposits. Igneous emanations mingled with ground-waters.

- A. Filling deposits.
- B. Replacement deposits.

V. Meteoric waters.

- A. Underground.
- B. Surficial.

This classification is intended to group the geological processes forming ore deposits in such a manner as to show genetic relations, and to illustrate the subdivisions proposed by actual examples, it being understood that investigators will differ as to which class a particular deposit might be assigned.

Major subdivisions are based upon magmatic segregations at one end, and cold aqueous deposits at the other, with intermediate groups due to the emanations from igneous rock, the eruptive after-actions of Vogt, to which the term pneumatolytic has commonly been given; fumarolic when these emanations issue at low temperature and pressure; gas-aqueous in which the emanations from igneous rocks, with their burden of metals, mingle with ground-water; aqueous in which meteoric waters alone are active, both chemically and mechanically.

The igneous deposits are divided into basic and silicious, the former including the deposits of iron, copper, etc., found at igneous borders and as dikes, the latter the ore-bearing pegmatites with quartz veins as extreme examples. Under igneous emanations or pneumatolytic deposits are grouped contact metamorphic deposits shown by recent studies to be formed under conditions which preclude the presence of ordinary ground-waters or steam at a low temperature and pressure. Pneumatolytic veins, of which Cornwall tin veins are classic examples, have long been recognized as due to eruptive after-actions of this character. Geikie, Fouqué and other geologists have observed the formations of metallic oxide in clefts in lavas by fumaroles, hence this division is introduced.

Under gas-aqueous the larger number of workable deposits occur, and it would be necessary to present a long list of facts assembled

to show their relations and the deductions therefrom, to establish the necessity for this subdivision; but if eruptive after-effects are admitted to form contact metamorphic deposits, etc., the next group follows as a logical consequence.

Meteoric waters are admittedly the agents that have by themselves formed large and important deposits of iron and copper, but this agency is assigned to a less important place than given it by recent writers. As a whole, the classification differs very markedly from any so far proposed, being the first to recognize the facts established by Vogt, Lindgren, Kemp, Spurr and other advocates of the igneous origin of ores.

In the discussion of Mr. Weed's paper, Mr. J. E. Spurr presented to the society a genetic classification of ore deposits, upon which he has been engaged for some years. He pointed out a general similarity between this and the classification proposed by Mr. Weed, especially as regards the important place given to ore deposits formed directly by igneous processes, and the classes into which these deposits are divided, the differences between the two schemes being largely differences in relative importance of the subdivisions and in detailed grouping. Mr. Spurr expressed his full sympathy with the theories of igneous origin for ore deposits, and recalled his own advocacy of these theories as early as 1894, when, in describing the deposits of Mercur, Utah, a gaseous origin for one of the two types found there was proposed, and a deposit in limestone along a porphyry contact by waters occluded from the porphyry for the other. Again in 1896 he argued that the gold quartz veins of the Yukon district were the final silicious products of differentiation of a granitic magma.

In his continuation of the discussion Mr. Waldemar Lindgren admitted the desirability of a genetic classification and believed that the suggestions of Weed and Spurr should be followed. Deposits formed by water above the critical temperature by igneous emanations and those formed by mingling of atmospheric and igneous water are important divisions. Fumaroles and solfataras are surface phenomena and very different from deep-seated

emanations. The conception of 'mineralizing agents' was defined, and it was shown that they may be active in magma, liquids and gases as well as in the reaction of gases on solids. A better term is desirable for deposits formed above the critical temperature of water than the variously used word 'pneumatolytic.' Contact metamorphic deposits are probably directly caused by the action of igneous emanations from cooling magmas, chiefly water, on the surrounding rocks at a temperature above the critical point. W. C. MENDENHALL,

Secretary.

CLEMSON COLLEGE SCIENCE CLUB.

THE club held its regular monthly meeting on Friday evening, January 16. The following papers were presented and discussed:

'The Salient Points in the Bacterial Analysis of Milk,' by Professor H. Metcalf. This paper described the conventional methods of milk analysis and was fully illustrated by experiments.

'Prescription Milk,' to which the first paper served as an introduction, was presented by Professor C. O. Upton. The treatment of this subject was based entirely upon the speaker's experience in the Walker-Gordon Laboratory Co., where the production of milk for clinical use is made a special work.

CHAS. E. CHAMBLISS,
Secretary.

DISCUSSION AND CORRESPONDENCE.

ORTHOPLASY, ETC.

IN SCIENCE, November 21, p. 820, Professor Conn treats 'Organic Selection' as a synonym of 'Orthoplasy,' stating that Professor Baldwin has preferred the latter term. In the work of Professor Baldwin reviewed (pp. 151, 152) we find these definitions:

"*Organic Selection*: The perpetuation and development of congenital variations in consequence of individual accommodation."

"*Orthoplasy*: The directive or determining influence of organic selection in evolution."

On p. 173 we read: 'The theory of evolution which makes general use of organic selection is called Orthoplasy.' Orthoplasy is,

therefore, not identical with organic selection, but its result.

I will take this opportunity to suggest a couple of terms:

Directive Characters.—Those characters which may be useless or harmful to the individual at the time of their development, but lead to after-effects which are the cause of survival, or are at least beneficial. Example: a wandering or migratory habit might be the cause of much hardship, but in the long run might lead the individual (if he survived the early stress) to exceptionally favorable conditions. Human emigrants often illustrate this course of events.

Directive Individuals.—Those individuals which may be useless or harmful to the race during their lifetimes, but lead to after-effects which are the cause of race-survival, or are at least beneficial. Example: many reformers, such as the abolitionists, have by their actions weakened the nation to which they belonged, for the time being; but the ultimate results have been highly advantageous.

T. D. A. COCKERELL.

EAST LAS VEGAS, N. M.

SHORTER ARTICLES.

ON THE PRIMARY DIVISION OF THE REPTILIA INTO TWO SUB-CLASSES, *Synapsida* AND *Diapsida*.

SINCE 1867 there has been a slowly progressive movement toward the classification of the reptiles by the number of arches in the temporal region of the skull. The leaders have been Günther, in the separation of the Rhyncocephalia from the Lacertilia, Cope, in the union of the Archosauria and separation of the Cotylosauria, Baur, Smith Woodward and Broom in the suggested division of reptiles into two groups according to the presence of one or two temporal arches. Broom in 1901 went so far as to assign a phylogenetic value to this distinction.

Without learning until a few days ago of Broom's paper* the writer had been for some time studying the value of this idea. Classification by single characters, such as the above,

* Through a review kindly sent the writer by Franz Baron Nopcsa, Jr., and received February 7, 1903.

has proved short-lived in so many cases that a thorough comparison of all parts of the skull and skeleton seemed absolutely necessary, and was undertaken by the writer with the valuable aid of Dr. J. Howard McGregor. It was found that the grouping suggested by the temporal arches is confirmed by a large number of characters unnoticed hitherto in this connection. On December 29, 1902, a joint-paper* was presented before the American Association in Washington in which the Reptiles were subdivided into two sub-classes as follows:

SUB-CLASS <i>Synapsida</i> .†	SUB-CLASS <i>Diapsida</i> .
<i>I. e.</i> , Primarily with single, or united temporal arches.	<i>I. e.</i> , Primarily with double or separated temporal arches.
<i>Cotylosauria</i> .	<i>Rhyncocephalia</i> :
<i>Anomodontia</i> :	<i>Proganosauria</i> .
<i>Dicynodontia</i> .	<i>Pelycosauria</i> .
<i>Cynodontia</i> .	<i>Mesosauria</i> , etc.
<i>Gomphodontia</i> .	<i>Dinosauria</i> .
<i>Theriodontia</i> .	<i>Ichthyosauria</i> .
<i>Placodontia</i> .	<i>Phytosauria</i> .
<i>Testudinata</i> .	<i>Pterosauria</i> .
<i>Plesiosauria</i> .	<i>Squamata</i> :
	<i>Mosasauria</i> .
	<i>Ophidia</i> .
	<i>Lacertilia</i> .
	<i>Crocodilia</i> .
Giving rise to the Mammalia from some unknown member of the Anomodontia.	Giving rise to the Birds through some unknown type transitional between Proganosauria and Dinosauria.

In the ancestral *Synapsida*: (1) The roof of the skull is solid (*Cotylosauria*), or there is a single large supratemporal opening, the infratemporal opening being rudimentary or

* Read before the biological section of the New York Academy of Sciences, February 9, 1903.

† The names *Protherosauria* (for *Synapsida*) and *Archosauria* (for *Diapsida*) were used in this communication. The former was abandoned because of its similarity of sound to *Proterosauria* Seeley. The latter was abandoned because Cope proposed *Archosauria* as a superorder to include only two-arched forms, whereas *Diapsida* is given sub-class rank and made to include the *Ichthyosauria*, *Phytosauria* and *Squamata*.

wanting; (2) the squamosal is large, coalescing with the prosquamosal and more or less covering the quadrate; (3) the quadrate is reduced and never movable; (4) the coracoid and procoracoid are separate, or united by suture; (5) the phalangeal formula is 2, 3, 3, 3, 3 or less than 2, 3, 4, 5, 3.

In the ancestral *Diapsida*: (1) The roof of the skull is open, with two temporal arches and openings; (2) the squamosal is small, frequently separate from the prosquamosal; (3) the quadrate is large, free and secondarily movable; (4) the coracoid and procoracoid are early coalesced into a single bone; (5) the phalangeal formula is 2, 3, 4, 5, 3-4.

These are the most striking of a series of characters which separate these groups. The grounds for placing the orders of Reptiles as they are in the above table will require fuller statement elsewhere.

HENRY F. OSBORN.

SCIENTIFIC NOTES AND NEWS.

DR. WILHELM WUNDT, the eminent psychologist, has been elected an honorary member of the Academy of Sciences of St. Petersburg.

PLANS have been inaugurated in Great Britain to secure by subscription a portrait of Lord Rayleigh. The treasurers are Sir Andrew Noble, Sir Oliver Lodge and Professor Arthur Schuster.

DR. A. E. ORTMANN, of Princeton University, has accepted the position of curator in invertebrate zoology in the Carnegie Museum, Pittsburgh.

M. EDMOND PERRIER has been appointed professor of comparative anatomy and M. Pierre Marcellin Boule, professor of paleontology in the Paris Museum of Natural History.

DR. M. VON RUDZKI has been made director of the observatory at Cracow in place of Professor Karlinski, who has retired.

PROFESSOR FORSYTH, of Cambridge University, was elected president of the Mathematical Association which held its annual meeting in London, on Saturday, January 23. The Association has 351 members.

DR. T. S. CLOUSTON has been elected president of the Royal College of Physicians, Edinburgh.

THE Royal Meteorological Society held its annual meeting on January 21, when Mr. W. H. Dines, the president, made an address entitled 'The Method of Kite-Flying from a Steam Vessel, and Meteorological Observations obtained thereby off the West Coast of Scotland.' The society now has 666 fellows. Captain D. Wilson-Barker was elected president for the ensuing year.

SIR MICHAEL FOSTER has reconsidered his intention to resign his seat as representative of London University in the House of Commons. He proposed to resign, because he did not wish to continue to vote with the unionist and conservative party, but he received assurances from graduates which lead him to retain his seat.

THE prize of \$200, annually given by Dr. Frederick Peterson for the best original essay on the etiology, pathology and treatment of epilepsy, was awarded this year to Dr. Julius Donath, of Budapest, Hungary, for his paper on 'The Presence of Cholin in Epilepsy and its Significance in the Production of the Convulsive Attack.'

THE American Museum of Natural History has sent Dr. E. O. Hovey to the Lesser Antilles again to supplement the studies which he made last summer on Martinique and St. Vincent. Dr. Hovey left New York by the steamer *Caribbee*, of the Quebec line, on February 4, and will remain in the Windward and Leeward Islands two months or more. After studying the changes which have taken place on Martinique and St. Vincent as a result of the great eruptions which have occurred since last July, he will visit all the other important volcanic islands of the chain to photograph their craters, solfataras and boiling lakes, with the object of making his final report upon the eruptions of 1902 in the West Indies comprehend the entire series of Caribbean volcanoes. He will make collections of volcanic rocks and other materials for the museum.

THE Danish government is about to send a commission to the Danish West Indies to investigate their condition. Professor Ehlers, of Copenhagen, will accompany the commission to investigate the diseases prevalent on the islands.

Two members of Baron Toll's polar expedition, Lieutenant Matissen, commander of the yacht *Zaria*, and Lieutenant Kolchak, have just arrived in St. Petersburg with nine men of the *Zaria*'s crew after an absence of two and a half years.

PROFESSOR HERBERT OSBORN, of the Ohio State University, gave an illustrated lecture on entomology before the Biological Club of DePauw University at Greencastle, Indiana, on the evening of January 28.

SIR WILLIAM BROADBENT will give the third Hughlings Jackson Lecture before the Neurological Society of London during the present year.

A MEETING in memory of the late John Wesley Powell will be held under the auspices of the Academy and affiliated scientific societies of Washington, at the Columbian University, on the evening of February 16, beginning at 8:15 o'clock. On this occasion the following addresses will be given:

'Powell as a Soldier,' by Hon. D. B. Henderson.

'Powell as an Explorer,' by Mr. Chas. R. Van Hise.

'Powell as a Geologist,' by Mr. G. K. Gilbert.

'Powell as an Ethnologist,' by Mr. W J McGee.

'Powell as a Man,' by Mr. S. P. Langley.

THE sum of \$1500 has been collected to erect in the Hunterian Museum of the University of Glasgow a memorial of the late Professor John Young. He had been since 1866 keeper of the museum and professor of natural history and lecturer on geology in the university.

A COMMITTEE has been formed in Germany to erect a memorial at Munich to Professor Pettenkofer in recognition of his important contributions to sanitation and hygiene.

SIR GEORGE GABRIEL STOKES, the eminent mathematician, died on February 1, in his eighty-fourth year. Born in Ireland, he was educated at Cambridge, where he was senior

wrangler in 1841, and became Lucasian professor of mathematics in 1849. He was fellow of Pembroke College, was compelled to resign, by his marriage, but was reelected under the statute of 1869 and became later president of the college. He was secretary of the Royal Society from 1854-1885 and president from 1885-1890, president of the British Association in 1869, and member of parliament from Cambridge University from 1887-1892. He was made a baronet in 1889 and was a knight of the Prussian order 'pour le mérite.' Sir George Stokes' contributions to mathematics and mathematical physics have given him a foremost place among the men of science of the world.

DR. MORRILL WYMAN, one of the best known American physicians, died at Cambridge on January 29, in his ninety-first year. He had made important contributions to medical science including the recognition of the disease known as hay fever. He was a member of the board of overseers of Harvard University, and received from it the degree of LL.D. in 1886.

IT is reported in the daily papers that Mr. John D. Rockefeller will build in New York City, for the Institute for Medical Research, which he has established, a research laboratory to cost with the ground about \$1,000,000. It is said that the buildings will be situated on the east side of the city in the neighborhood of Eightieth St.

THE German government has appropriated \$15,000 for research for the study of the relation between tuberculosis in man and cattle.

A BILL has been introduced in the House by Mr. Slayden, of Texas, appropriating \$50,000 to aid in the suppression of the bubonic plague in Mexico, and to prevent its spread in the United States. For this purpose the bill authorizes and directs the President of the United States to send a commission of three medical officers of the army and navy to investigate and report the conditions as to this disease there prevalent.

THE Pennsylvania Legislature has repealed the Fow Anti-hospital Law, and Philadelphia can now accept the Henry Phipps proposed gift of \$1,000,000, and erect near the center of

population an institute for the study, treatment and prevention of tuberculosis.

ROBERT E. WOODWARD, of Brooklyn, has given \$25,000 to the Brooklyn Institute of Arts and Sciences, in memory of his brother, the late General John B. Woodward, and an additional \$25,000 in memory of his wife.

The British Medical Journal states that the sum of £10,000 has been vested in trustees by Mr. T. Sutton Timmis, for the purpose of systematic investigations into the origin and cure of cancer, which it is intended shall be carried out in the Liverpool Royal Infirmary and the new laboratories of experimental medicine in the University College, Liverpool.

AN international conference to discuss the question of erecting an international seismic observatory in Europe will be held at Berne in May. The principal European governments have agreed to send representatives.

THE Wisconsin State Board of Agriculture is considering the preservation of a group of three mounds located in State Fair Park at West Allis near Milwaukee. The Wisconsin Natural History Society is to see that these mounds are labeled. There are about one hundred large and several hundred small collections of antiquities in Wisconsin. The society is making efforts to have these placed in various libraries, museums and schools.

THE Department of Superintendence of the National Educational Association holds its meeting at Cincinnati from February 24 to 26. Among the addresses and papers are 'How to utilize fully the plant of a city school system,' President Eliot of Harvard University; 'The University of Oxford and Rhodes Scholarships,' Dr. W. T. Harris, commissioner of education; 'Some problems in manual training,' Professor C. R. Richards, Columbia University; and 'Coeducation in high schools and universities,' Professor Albion W. Small, University of Chicago. The National Society for the Scientific Study of Education, The Association of College Teachers of Education and the Educational Press Association meet at the same time and place.

ON February 3, the following papers were read before the Mineralogical Society of Great Britain and Ireland, at Burlington House, London, England: 'On a meteoric stone seen to fall on August 22, 1902, at Caratash, Smyrna': by L. Fletcher, Esq., M.A., F.R.S.; 'Note on the history of the mass of meteoric iron found in the neighborhood of Caperr, Patagonia': by the same; 'On the crystalline forms of carbides and silicides of iron and manganese': by L. J. Spencer, Esq., M.A., F.G.S.; 'The refractive indices of Pyromorphite': by H. L. Bowman, Esq., M.A., F.G.S.; 'Note on quartz crystals from De Aar': by T. V. Barker, Esq. The following dates have been arranged for the meetings for 1903: February 3, March 24, June 9, November 17, anniversary.

'WHY Salt Lake has fallen' is the subject of a paper by L. H. Murdoch, section director of the U. S. Weather Bureau in Salt Lake City, in the *National Geographic Magazine* for February. The rapid decline in the water level of Great Salt Lake during the past few years has caused the people of northern Utah, and more especially those of Salt Lake City, to feel considerable apprehension lest this remarkable body of water will soon be a thing of the past. The reading of the gauge at Garfield Beach on December 1, 1902, was 3 feet 5 inches below the zero of the scale, showing a fall of 11 feet 7 inches since the close of 1886, the year in which the last rise terminated. The present area of the lake is about 1,750 square miles, and its drainage basin is about twenty times that area. The writer feels confident that irrigation can not be charged with more than three or four feet of the last decline in the lake level as irrigation began in 1848, and was in operation during the years that the lake rose rapidly and maintained a high level. From 1887 to 1902 a dry cycle has prevailed, the average precipitation during this period being 14.80 inches or 1.85 inches below normal. The fall in the lake level has been much more rapid during the past three years than for any like period during the preceding years of drought. This is mainly due to the fact that the deficiency in

precipitation has been greater during this period than during any similar period of the present dry cycle. The deficiency for the last three years alone was over 13 inches. The lake is not alone in showing the effects of the drought. Streams, springs and artesian wells are drying up, and those which continue active are discharging much less water than a few years ago. It seems to the writer that the large deficiency of 29.60 inches in precipitation during the past sixteen years, as shown by the Salt Lake City records, must be far more of a factor than any possible loss of water resulting from irrigating 609 square miles of land. With precipitation continuing at about 15 inches, no further fall in the lake will occur, and if the annual precipitation is as much as 15 inches for the next three years, a slight rise may be expected. A wet cycle like that which began in 1865 may begin next year, or it may not begin for fifty or more years. When it does occur the lake will respond rapidly and reach levels nearly as high as those recorded in the sixties and seventies.

THE Mathematical Association (London) has received a report from its committee to consider the subject of the teaching of elementary mathematics. According to the abstract in the *London Times* the report of this committee stated, with regard to geometry: "It is desirable (1) that a first introduction to geometry should not be formal, but experimental, with use of instruments and numerical measurements, and calculations; (2) that public schools in their entrance examinations should set a fair proportion of questions requiring the use of instruments, and the obtaining of numerical results from numerical data by measurements from accurately drawn figures; and that in their entrance scholarship examinations the same principle should be recognized; (3) that elementary geometry papers, in examinations such as University local examinations, the examinations of the College of Preceptors, Oxford responses, and the Cambridge previous examination, should contain some questions regarding the practical use of instruments; (4) since pupils will have been already familiarized with the prin-

cipal constructions of Euclid before they begin their study of formal geometry, it is desirable that the course of constructions should be regarded as quite distinct from the course of theorems. The two courses will probably be studied side by side, but great freedom should be allowed to the teacher as to the order in which he takes the different constructions." The report proceeded to deal with the course of constructions, the course of theorems, and the importance of riders. The committee recommended the following general order in teaching the theorems of the first three books, and thought that examiners should be requested to recognize this order:—Book I., Book III. to 32 inclusive, Book II., Book III. 35 to the end; and detailed suggestions were given. As to arithmetic and algebra, the committee considered that there was considerable danger of the true educational value of arithmetic and algebra being seriously impaired by reason of a tendency to sacrifice clear understanding to mere mechanical skill. In view of this they recommend—(a) that easy *viva voce* examples should be frequently used in both arithmetic and algebra; (b) that great stress should be laid on fundamental principles; (c) that, as far as possible, the rules which a pupil uses should be generalizations from his own experience; (d) that, whenever practicable, geometry should be employed to illustrate arithmetic and algebra, and in particular that graphs should be used extensively; (e) that many of the harder rules and heavier types of examples, which examinations alone compel us to retain in a school curriculum, should be postponed. With these as guiding principles the committee made various suggestions. In view of the great amount of time now required for teaching the various rules connected with our complicated system of weights and measures, the committee recorded its unanimous opinion that the interests of education demanded the early introduction of a decimal system of weights, measures and coinage.

UNIVERSITY AND EDUCATIONAL NEWS.

THE Duke de Loubat has given \$100,000 to Columbia University for the establishment of

a chair of American archeology. Mr. M. H. Saville, curator at the American Museum of Natural History, has been elected to the professorship.

OVERLIN COLLEGE has received an anonymous gift of \$50,000 from the same donor who recently gave \$50,000.

MR. ALEXANDER C. HUMPHREYS was installed as president of the Stevens Institute of Technology on February 5. Addresses were made by representatives of the trustees and faculty, by President Charles S. Thwing, of Western Reserve University, by President Henry S. Pritchett, of the Massachusetts Institute of Technology, and by Mr. Andrew Carnegie. The alumni offered a dinner and reception to President Humphreys in the evening.

AN extension of the work of the College of Physicians and Surgeons, Columbia University, is about to be inaugurated by the establishment of summer courses. Practical instruction will be given in general medicine by Drs. Sumner and Draper; in neurology by Drs. Pearce Bailey and Cunningham; in gynecology by Drs. W. S. Stone and Bradley; in obstetrics by Dr. Lobenstine; in ophthalmology by Drs. Clairborne, Holden and Tyson; in laryngology by Drs. Simpson and Frothingham; in dermatology by Drs. Hodgson and Dade; in diseases of children by Drs. La Feta and Huber; in genito-urinary diseases by the senior assistants in the department; in diseases of the stomach and intestines by Dr. Fischer; in clinical pathology by Dr. Jessup; and in physical diagnosis by Dr. Dow. Each course continues for a period of from three to five weeks, and the work will be adapted to the needs of undergraduates of the third and fourth years, and of practitioners of medicine who desire to pursue further special studies.

DR. K. ALFRED OSANN, of Mülhausen, has been appointed associate professor of mineralogy at the University of Freiburg.

SIR WILLIAM TURNER has been appointed principal of the University of Edinburgh. He has been demonstrator of anatomy in the university since 1854 and professor since 1867.